T S8/KWIC/1-6

8/KWIC/1 (Item 1 from file: 349)
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Fulltext Availability:
Detailed Description
Claims

Detailed Description
... of transmitting electrical power, particularly AC electrical power has significant congestion paths, known herein as **flow gates** .

There has been little economic incentive to increase the transmission capacity through the **flow gates** , in part because there is no coherent policy provided fair and predictable economic return to...

...energy industry brought many things with it, including a restriction to only short-term energy **contracts** . As the older, long term **contracts** ended, this left the bulk of the state's energy costs vulnerable to daily market...load. A bus connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network...change. The National Electric Reliability Council computes a system of a set of numbers -called **power transfer** distribution factors available on the North American Reliability Council website, www.nerc.com, showing how...AC power network refers herein to a collection of at least one line whose total **maximum** safe **carrying capacity** acts as a congested element of the network, constraining AC power delivery between two ...referred to as significant flowgates. Path15 is io considered a significant flowgate.

The associated AC **power transfer** across a given flowgate is additive due to the super positioning effects previously discussed. Thus...Lines 32, 34 and 42 are io constrained by flowgate A 210 by a total **maximum** safe **carrying capacity** , in that these lines have transmission **capacity** limitations which are easily overloaded when this **maximum** safe **carrying capacity** is exceeded.

Flowgate B 220 is a constraint on the network. Lines 42 and 4...the network. Lines 52 and 62 are constrained by flowgate C 230 to a total **maximum** safe **carrying capacity** .
By way of example, a mountain range such as the Cascade mountain range in the...the values in
1 1
the first row of Figure 2 indicate the ratio of **power transferred** across flowgates A, B, and C. If the power is ...at Bus 1 , the same values apply but are of reversed sign.

Consider how AC **power transfers** are managed today in most of North Amerca. Transmission rights are considered and negotiated in terms of pointto-point transfers within the network known as **contract** paths. Such thinking is contrary to the previously discussed physics of these AC power networks **contract** path system maintains the fiction that AC power

can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with, the **contract** path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.
Today's **contract** path is a first-come, first-served priority scheme. What is 2o bought has very...

...transmission from A to B and bought a transmission from B to C. Using the **contract** path approach, does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning
power transmission from A to B and from B to...the two separate paths which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once you have purchased the transmission from AThese **contract** path approaches
ignore the physics of AC power networks. This leads to situations where even...solution that is based upon the power distribution matrix. This is a matrix of all **power** **transfer** distribution factors between nodes of the AC power network.

This approach suffers from at least...

...limited amount of detailed information such a system can acquire, or use, to optimize AC **power** **transfers** . The **power** users are again blind to their options. The players
cannot determine what works ...large
numbers of flowgates and providing users with a straightforward method of trading the AC **power** **transfer** , while discouraging gaming opportunities.

io What is needed is a system supporting trading transmission rights potential flowgate
right and providing users with straightforward trading mechanisms for AC **power** **transfer** . Such trading mechanisms insure compliance with flowgate
constraints, and thus the physics of AC power...of trading fungible, ephemeral
commodities, including, but not limited to, DC and AC electricity, AC **power** **transfers** , flowgate rights, and point-to-point AC **power** **transfer** rights with bundled flowgate transmission rights.

is
The invention advantageously provides a seamless integration from...
Figure 7B depicts a refinement of Figure 3B of a market interval of an AC **power** **transfer** product type;
Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power** **transfer** product type;
Figure 7D depicts a refinement of Figures 7B and 7C of a market interval of
an AC **power** **transfer** point- ...by the first party, to act on behalf of the first party with respect to **contracting** .

Server system 3500 includes at least one server computer 3520 coupled to io network 3200...various personal optimizations and shortcuts,

including, but not limited to, macro style functions and standard **contract** forms employed by the ...collection may be a member of a product type collection comprised of energy and AC **power transfer** . The location of a market interval having an energy product type may 2o be a...

...contained in the electrical power grid. The location of a market interval having an AC **power transfer** product type may be from a first node of a first AC power network contained...one month.

A lot is the quantity in multiples of which an order must be **contracted** .

2o A basic function of a market segment is to match ...7B depicts a refinement of Figure 3B of a market interval of an AC io **power transfer** product type. The product type 1110 of the market interval is further described as an...Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power transfer** product type. The product type 1 1 1 0 of the market interval is describedasanEnergyproducttypelIlO...market to trade transfer capability between
70
users. Because of the linear nature of AC **power transfer** throughout an AC **power** network, these **transfer** rights can be linearly accumulated to insure the **contracted** transfers are physically feasible in satisfying the overall flowgate constraints of the AC power network.

...depicts a refinement of Figures 7B and 7C of a market interval of an AC **power transfer** point-to-point product type. The product type 1 1 1 6 of
the market...second node of
the first AC power network. However, a market interval for an AC **power transfer** point-to-point product type further possesses all the ancillary flowgate transmission rights required for...liquidity, participants should be very
comfortable posting bids and offers for point-to-point AC **power transfer** rights, since they constitute complete products from a participant perspective.

71
Bids for AC **power transfer** point-to-point market intervals are comprised of bids'-for at least one flowgate transmission right sharing the same location.

Bids for AC **power transfer** point-to-point market intervals may further
comprise bids for each of the flowgates of the flowgate collection sharing the same location. Bids for AC **power transfer** point-to-point market intervals may further comprise transmission rights for at least one flowgate...a collection of constrained transmission lines, will be denoted by a flowgate designator. An AC **power transfer** amount from nodel to node2 produces an amount of AC **power transfer** across the flowgate as essentially an associated linear, skew symmetric function of the amount from is at least one market interval in the market interval collection of AC **power transfer** product type with the flowgate'location.

73
Each validated order of the validated order collection with the AC **power**

transfer product type of the associated market interval may further contain an amount. A validated order of AC **power** **transfer** product type from the first node to the second node may be further comprised of ...that there may be a price associated with each validated order of the AC io **power** **transfers** of the flowgates. There may be a price associated with the AC **power** **transfer** from the first node to the second node.

Figure 9A depicts a market interval of...second node of a second AC power network. The product type collection further comprises DC **power** **transfer** . For each DC power line of the DC power line collection, there is at least one associated market interval with DC **power** **transfer** product type, with the location as the location of the DC power line.

Figure 9B...1998. The current market price in dollars per megawatt hour 7010 is "12.96". The **contracted** position in net megawatts 7012 is "12.00". The pending position in net megawatts 7014which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...7102.
The current market price in dollars per megawatt-hour 7110 is "16.72". The **contracted** position in net megawatts 7112 is 1 0.00". The pending position in i5 net...

...position in net megawatts 7116 is "l 0.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...has a succession of rows with entries from 1 to 24, indicating the hourly AC **power** **transfer** markets 7204 in the flowgate location "Flowgate-a" 7202. Consider the row labeled by the...

...ending at "V. This row displays the market state of the market interval with AC **power** **transfer** product type, flowgate 7202 location and hour time interval ending at 1:00 for May...

...1999. The current market price in dollars per megawatt-hour 7210 is "O.00". The **contracted**

position in net megawatts 7212 is "O.00". The pending position in ... total position in net megawatts 7216 is "O.00", which is the sum of the **contract** and pending positions for that market interval.
The **contracted** flow 7224 is "O.00". The pending flow 7226 is "O.00". The total flow...the source generation, transmission rights and destination loading, where applicable, which preferably becomes a single **contract** . This creates a fundamental simplification in the conceptual effort required to trade energy delivery.

Figure...of Figure 26.

Note that at least one of the market intervals contains an AC **power** **transfer** product type as the fungible, ephemeral commodity and contains the location as a first of...each be further based upon the flowgate collection.

The market interval may contain the AC **power** **transfer** product type as the fungible, ephemeral commodity and further, the market interval may contain an AC **power** **transfer** point-to-point product type as the

fungible, ephemeral commodity.

Figure 28A depicts a detail...contained in the flowgate collection, at least one of the market intervals contains the AC **power transfer** product type as the fungible, ephemeral commodity and the location coinciding with the flo'wgate...

Claim
... of Claim 1 1,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral ...contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...The system of Claim 13,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.
114
. The system of Claim...the program steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate...amount, and a price;
an ask specification containing said amount, and said price; and
an **contract** specification containing said amount and said price;
wherein the program step managing said market trade...method of Claim 41,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
127
said location as a first one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...The method of Claim 43,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.

45 The method of Claim...including the steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate...system of Claim 74,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
said location as a first of...contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said fiowgate entry...

...The system of Claim 76,

wherein said product type is further comprised of an AC **power transfer**

io point-to-point product type as said fungible, ephemeral commodity.

78 The system of...including:
a means for generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least ...system of Claim 109,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
said location as a first of...contained in said flowgate collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...said flowgate collection.
112. ThesystemofClaim111,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.
113. ThesystemofClaim112,
158
wherein the...including the steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate lo entry, for at least one...of Claim 143,
wher ein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
said location as a first of...contained in said flowgate collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...The method of Claim 145,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral ...including the steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding ... contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with ...The system of Claim 178,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.
180. The system of Claim...including:
a means for generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate...

8/KWIC/2 (Item 2 from file: 349)
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Fulltext Availability:
Detailed Description
Claims

English Abstract
...for the new bundles exceeds the aggregate offers for the old bundles, the optimization system **contracts** orders for the bundles and performs the disassembly and reassembly. The invention provides a participant...

...quote attractive places an order at any time and is assured that the order will **contract** at the quoted price.

Detailed Description
... of transmitting electrical power, particularly AC electrical power has significant congestion paths, known herein as **flow gates** . There has been little economic incentive to increase the transmission capacity through the **flow gates** , in part because there is no coherent policy provided fair- and predictable economic return to...

...energy industry brought many things with it, including a restriction to only short-term energy **contracts** . As the older, long term **contracts** ended, this left the bulk of the state's energy costs vulnerable to daily market...load. A bus connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network...change. The National Electric Reliability Council computes a system of a set of numbers called **power transfer** distribution factors available on the North American Reliability Council website, www.nerc.com, showing how...C power network refers herein to a collection of at least one line whose total **maximum** safe **carrying capacity** acts as a congested element of the ...herein referred to as significant flowgates. Path15 is considered a significant flowgate.

The associated AC **power transfer** across a given flowgate is additive due to the super positioning effects previously discussed. Thus...Lines 32, 34 and 42 are constrained by flowgate A 21 0 by a total **maximum** safe **carrying capacity** , in that these lines have transmission **capacity** limitations which are easily overloaded when this **maximum** safe **carrying capacity** is ...the network. Lines 52 and 62 are constrained by flowgate C 230 to a total **maximum** safe **carrying capacity** .
6
By way of example, a mountain range such as the Cascade mountain range in ...1 1 , the values in the first row of Figure 2 indicate the ratio. of **power transferred** across flowgates A, B@ and C. If the power is generated at Bus 1 1...

...at Bus 1, the same values apply but are of reversed sign.

Consider how AC **power transfers** are managed today in most of North Arnerca.

Transmission rights are considered and negotiated in terms of point-to-point transfers within the network known as **contract** paths.

Such thinking is contrary to
the previously discussed physics of these AC power networks...in the network, and consequently impact all flowgates within that network to some extent.

The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because a was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** path approach is that
8
the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.

Today's **contract** path is a first-come, first-served priority scheme. What is bought has very limited...

...transmission from A to B and bought a transmission from B to C. Using the **contract** path approach, does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning
power transmission from A to B and from B to...

...approaches to limiting flow on one path because
of the impact on another path. These **contract** path approaches ignore the
physics of AC power networks. This leads ...is based upon the power distribution matrix. This is a 1 0 matrix of all **power transfer** distribution factors between nodes of the AC power network.

This approach suffers from at least...

...limited amount of detailed information such a system can acquire, or use, to optimize AC **power transfers** . The **power** 1 5 users are again blind to their options. The players cannot determine what works...numbers of flowgates and providing users with a straightforward method of trading the A C **power transfer** , while discouraging gaming opportunities.

What is needed is a system supporting trading transmission rights and...

...flowgate right, and potential flowgate right and providing users with straightforward trading mechanisms for AC **power transfer** . Such trading ...for the new bundles exceeds the aggregate offers for the old bundles, the optimization system **contracts** orders for the bundles and performs the disassembly and reassembly.

The invention provides a participant...quote attractive places an order at any time and is assured that the order will **contract** at the quoted price.
Participants can therefore negotiate energy deals on any terms they wish
...Figure 7B depicts a refinement of Figure 3B of a market interval of an AC **power**
transfer product type;
Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power**
transfer product type;
Figure 7D depicts a refinement of Figures 7B and 7C of a market interval

of an
AC **power** **transfer** point-to-point product type;
Figure 8 depicts a validated order 1200 comprised of at...by the first party, to act on behalf of the first party with respect to **contracting** .

Server system 3500 includes at least one server computer 3520 coupled to network 3200. Network...various personal optimizations and shortcuts, including, but not limited to, macro style functions and standard **contract** forms employed by the client 1400.

Server system 3500 may include at least one server...collection may be a member of a
product type collection comprised of energy and AC **power** **transfer** . The
...contained in the electrical power grid.

The location of a market interval having an AC **power** **transfer** product type may be from a first node of a first AC power network contained...one month.

A lot is the quantity in multiples of which an order must be **contracted** .

A basic function of a market segment is to match buy and ...Figure 7B depicts a refinement of Figure 3B of a market interval of an AC **power** **transfer** product type. The product type 1 1 1 0 of the market interval is further ...Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power** **transfer** product type. The product type 1 1 1 0 of the ...a market to trade transfer capability between users.

Because of the linear nature of AC **power** **transfer** throughout an AC **power**
network, these **transfer** rights can generally be linearly accumulated to insure the **contracted** transfers are physically feasible in satisfying the overall flowgate constraints of the AC power network...
...depicts a refinement of Figures 7B and 7C of a market interval of an AC **power** **transfer** point-to-point product type. The product type 1 1 16 of the market interval...node of the first A C power network. However, a market interval for an AC **power** **transfer** point-topoint product type further possesses all the ancillary flowgate transmission rights required for the...liquidity, participants should be very comfortable posting bids and offers for point-to-point AC **power** **transfer** rights, since they constitute complete products from a participant perspective.

Bids for AC **power** **transfer** point-to-point market intervals are comprised of ...for at least one flowgate transmission right sharing the same location. Bids for A C **power** **transfer** point-to-point market intervals may further comprise bids for each of the flowgates of the flowgate collection sharing the same location. Bids for A C 1 0 **power** **transfer** point-to-point market intervals may further comprise transmission rights for at least one flowgate...a collection of constrained transmission lines, will be denoted by a flowgate designator. An AC **power** **transfer** amount
from nodel to node2 produces an amount of AC **power** **transfer** across the
flowgate as essentially ...collection, there is at least one market interval in the market interval collection of AC **power** **transfer** product type with the flowgate location.

Each validated order of the validated order collection with the AC **power**

transfer product type of the associated market interval may further contain an amount. A validated order of AC **power** **transfer** product type from the first node to the second node may be further ...Note that there may be a price associated with each validated order of the AC **power** **transfers** of the flowgates. There may be a price associated with the A C **power** **transfer** from the first node to the second node.

Figure 9A depicts a market interval of...second node of a second AC power network. The product type collection further comprises DC **power** **transfer** . For each DC power line of the DC power line collection, there is at least one associated market interval with DC **power** **transfer** product type, with the location as the location of the DC power line.

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Figure...current market price in dollars per megawatt-hour 701 0 is 1 2.96". The **contracted** position in net megawatts 7012 is 1 2.00". The
53
pending position in net...

...total position in net megawatts 7016 is "25.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...7102.

The current market price in dollars per megawaff-hour 7110 is "16.72". The **contracted** position in net megawatts 7112 is "10.00". The pending position in net megawatts 7114 **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...has a succession of rows with entries from 1 to 24, indicating the hourly AC **power** **transfer** markets 0 7204 in the flowgate location "Flowgate-a" 7202. Consider the row labeled b interval with AC **power** **transfer** product type, flowgate 7202 location and hour time interval ending at 1:00 for May...

...The current market price in dollars per megawatt-hour 721 0 is "O.00". The **contracted** position in net megawatts 5 7212 is "O.00". The pending position in net megawatts...

...total position in net megawatts 7216 is "O.00", which is the sum of the **contract** and pending positions for that market interval. The **contracted** flow 7224 is "O.00".

The pending flow 7226 is "O.00". The total flow...the source generation, transmission rights and destination loading, where applicable, which preferably becomes a single **contract** . This creates a fundamental simplification in the conceptual effort required to trade energy delivery.

Figure...of Figure 26.

Note that at least one of the market intervals contains an AC **power** **transfer** product type as the fungible, ephemeral commodity and contains the location as 1 0 a...each be further based upon the flowgate collection.

The market interval may contain the AC **power** **transfer** product type as the fungible, ephemeral commodity and further, the market interval may contain an

AC **power transfer** point-to-point product ...contained in the flowgate collection, at least one of the market intervals contains the AC **power transfer** product type as the fungible, ephemeral commodity and the location coinciding with the flowgate entry...for the new bundles exceeds the aggregate
offers for the old bundles, the optimization system **contracts** orders for the bundles and performs the disassembly and reassembly.

The optimization system performs some...seconds if orders were coming in more often than every few seconds. Since orders are **contracting** continuously, the invention provides a true forward market, with prices locked-in at the time of **contracting** .

Aside from speed, another nice feature of LPs is that they give a shadow price...

...prices would always be available, even when the LIP was run and 1 0 nothing **contracted** . The component prices could be used to calculate ...quote attractive places an order at any time and is assured that the order will **contract** at the quoted price. Participants can therefore negotiate energy deals on any terms they wished...exceed
AZ-CA reused).

This example is simple enough to work by hand. The resulting **contract** will be
y1=50 MW (that is, 50 MW of bundle 1 bought) and y2...placed the order, not the account name). Bids and offers with which the user cannot **contract** (due to counterparty selections, if using Self-Managed credit) appear with the same background color...bid or offer depth on a row changes for any reason (such as an order **contracted** or withdrawn), the bid and offer columns blink briefly to provide a clear visual signal...in bold.

'Virtual" orders are shown in Italics.

a. Orders with which the participant cannot **contract** due to credit selections are 1 0 shown against the same color background as is...new orders, on behalf of participant "Specify Later'.

Orders with which the selected participant cannot **contract** due to counterparty selection should appear with the background color used for titles and borders...

...would on the participant's own screen. The "Specify Later' participant should be able to **contract** with all orders. It is the broker's responsibility to be aware of any restrictions that apply to a participant's ability to **contract** when that participant is to be specified later (this should not be an issue in Scandinavia, where all orders should be able to **contract**).

When the broker enters an order using the Order Entry pop-up window or the...SC as well as the customers of other QSE/SCs using APX systems under ASP **contracts** . This section refers to
these customers as "APX participants". For example, Aquila is an APX...a negative offer, not a bid.

0
The concept here is that, when everything is **contracted** , the absolute bid quantity will become the 'net **contracted** buys by the participant from the counterparty.

Similarly, the absolute offer quantity will become the 'net **contracted** sells by the 5 participant to the counterparty.

"Incremental" ...APX Market and Bilateral transactions are shown, not asset transfers.

In this report, each separately **contracted** portion of an order is considered a separate transaction. If the order was split into several **contracts** by quantity (for example 50 MW with counterparty A and 50 MW with counterparty B into several **contracts** by time (for example, the usees daily 0 on-peak order was matched with 16 hourly orders), then only the **contract** portions spanning the specific interval are listed under that interval.

As usual, the delivery time...give the user a chronological listing of all transactions according to the time the order **contracted** . The report is sorted by transaction time, then by delivery interval. As with the APX Market and Bilateral Transactions by Delivery Interval report, each separately **contracted** portion of an order is considered a separate transaction. Only APX Market and Bilateral transactions...

Claim
... exceeds aggregate
offers of component elements of said sale bundles, then said continuously searching step **contracts** orders for bid bundles ...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

5 The process of Claim 1, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

9 A process for the bundling and trading of energy and...bundle exceeds aggregate
offers of component elements of said sale bundles, then said optimization means **contracts** orders for bid bundles and sale bundles and performs disassembly of sale bundles and reassembles...quote can place an order at any time and be assured that said order is **contracted** at said price quote.
205
. The process of Claim 9, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

17 An apparatus for the bundling and trading of energy and of component elements of said sale bundles, then said continuously
searching module **contracts** orders for bid bundles and sale bundles and performs disassembly of sale bundles and reassembles...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

21 The apparatus of Claim 17, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

25 An apparatus for the bundling and trading of energy and...bundle exceeds aggregate
offers of component elements of said sale bundles, then said optimization means **contracts** orders for bid bundles and sale bundles and performs

...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

29 The apparatus of Claim 25, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.
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8/KWIC/3 (Item 3 from file: 349)
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Fulltext Availability:
Detailed Description

Detailed Description
... A bus locally connects these local facilities of a node. High voltage AC transmission
lines **transfer** **power** between the cities and the generators in major load
centers of an AC power network...change. The National Electric Reliability Council computes a system of a set of numbers called **power transfer** distribution factors available on the North American Reliability Council website, www.nerc.com, showing how...

...different transformers
may have differing transformer capacity limits. These constrained flow lo elements are called **flow** **gates** . In the last few years the importance of **flow**
gates has begun to emerge through the actions of NERC, which has been responsible for building a model estimating **flow** **gate** impact, which can be downloaded from their web site.
A **flow** **gate** of a given AC power network will refer herein to a collection of at
least one line whose total **maximum** safe **carrying** **capacity** will act as a
congested element of the network, constraining AC power delivery between two...

...of that network.

All lines have maximum safe carrying capacities and thus could be considered **flow** **gates** , of a sort. However, historical congestion analysis of specific AC power networks reveals that only a small number of **flow** **gates** account for almost all congestion problems. Such **flow** **gates** will be herein referred to as significant **flow** **gates** .

The associated AC **power** **transfer** across a given **flow** **gate** is additive due to
the super positioning effects previously discussed. Thus in sending 1 00 megawatts along a path, the transmission may have a 1 0% impact on the **flow**
6
gate , putting 10 megawatts on the **flow** **gate** . A second generator may have a
5% impact on that **flow** **gate** . Generating 100 megawatt at the second generator would add 5 megawatt across the **flow** **gate** .

Figure 1 depicts an exemplary AC power network based upon contemporary AC power technology as...

...1 0. Line 11 2 runs between node I 1 0 and node 120.

2o **Flow gate** A 210 is a constraint on the network. Lines 32, 34 and 42 are constrained by **flow gate** A 210 by a total **maximum** safe **carrying capacity** , in that these lines have transmission **capacity** limitations which are easily overloaded when this **maximum** safe **carrying capacity** is exceeded.

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Flow gate B 220 is a constraint on the network. Lines 42 and 44 are constrained by **flow gate** B 220. These lines are also constrained by a total **maximum** safe **carrying capacity** due to system limitations, such as their proximity at some critical junction of the system, such as a mountain pass.

Flow gate C 230 is a constraint on the network. Lines 52 and 62 are constrained by **flow gate** C 230 to a total **maximum** safe□carrying□ **capacity** .

Figure 2 depicts a list of associated AC power functions for each **flow gate** of a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...

...1 1 , the values in the first row of Figure 2 indicate the ratio of **power transferred** across **flow gates** A, B, and C. If the power is generated at Bus 1 1 and consumed...

...commodities or the economic results of transactions involving ephemeral, fungible electrical commodities.

Consider how AC **power transfers** are managed today in most of North Amerca. Transmission rights are considered and negotiated in terms of pointto-point transfers within the network known as **contract** paths. Such thinking is contrary to the previously discussed physics of these AC power networks...

...an essentially linear effect on all transmission lines in the network, and consequently impact all **flow gates** within that network to some extent.

This **contract** path system of scheduling power transmission reserves transmission rights along a particular, direct path through...

...making up the direct path. It often occurs that some constraint, occurring across a significant **flow gate** off that direct path, actually limits the transmission capability on the direct path.

The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** io path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an

AC power network.

Today's **contract** path is based upon a first-come, first-served priority scheme.

What is bought has...

...power transmission from A to B and bought a transmission from B to C. Using **contract** path approach, that does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning power transmission from A ...to purchase separately transmission from A to C. this is because there might be some **flow gate** constraint which would not be met in the two separate paths which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once you have purchased the transmission from A...

...approaches to limiting flow on one path because of the impact on another path. These **contract** path approaches ignore the physics of AC power networks. This leads to situations where even...

...path becomes over-constrained, cuts are issued to compensate. The central operator acts, because a **flow gate** will attempt to exceed its safe carrying capacity, forbidding transmission often across apparently irrelevant paths...

...solution that is based upon the power distribution matrix. This is a matrix of all **power transfer** distribution factors between nodes of the AC power network.

This approach suffers from at least...

...limited amount of detailed information such a system can acquire, or use, to optimize AC **power transfers** . The **power** users are again blind to their options. The players cannot determine what works best for...

...commitment decisions. Nor can price risks be easily hedged.

NERC has developed a methodology addressing **flow gates** to some extent.
2o This is discussed in a document entitled "Discussion Paper on Aligning ...

...shift to a system of reserving and scheduling transmission based on actual use of congested **flow gates** , which they called the 13
FLOWBAT method. Their proposal suffers from a serious omission, it does not address the issue of allocating **flow gate** capacity when demand exceeds supply. By their silence on this issue, it appears that they...

...case called Transaction Participation Functions (TPFs).

These distribution functions refer to transmission paths rather than **flow gates** .

GAPP attempts to align compensation paid by transmission users with actual power flows. However, GAPP is strictly an after-the-fact

settlement system. It alters the current **contract** path scheme only to redistribute the revenue. It does not attempt to allocate scarce transmission...the physics of AC power networks. Further, since transmission rights are predominantly constrained by significant **flow gates** , what is needed should account for the effect on the significant **flow gates** for each **contracted** transmission. A method and mechanism is needed for trading generation and transmission rights in a...the prior art; Figure 2 depicts a list of associated AC power functions for each **flow gate** of a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...

...Figure 6B depicts a refinement of Figure 3B of a market interval of an AC **power transfer** product type; Figure 7 depicts a validated order 1200 comprised of at least two validated...

...has passed; Figure 10A depicts a detail flowchart of operation 2000 of Figure 4 performing **contracting** to create an agreed **contract** from said validate d order collection; Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from said validated order collection; Figure 11A depicts a detail flowchart of operation 2022 of...operation 2092 of Figure 1 OA performing notified biding and asking clients of the agreed **contract** for their respective validated orders; Figure 17A depicts a detail flowchart of operation 2004 of...

...18C depicts a detail flowchart of operation 2120 of Figure IOB performing creating the agreed **contract** at the agreed price and the agreed option price for the agreed amount whenever the...

...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain io embodiments of the invention; Figure 25 depicts a flowchart...collection may be a member of a product type collection comprised of energy and AC **power transfer** . The location of a market interval of an energy product type may be a first...

...contained in the electrical power grid. The location of a market interval of an AC **power transfer** product type may be from a first node of a first AC power network contained...are not limited to acoustic interfaces to humans, audio and visual identification portals to the **contracting** of AC **power transfer** regarding **flow gates** , encoding and decoding mechanisms used in long distance communication and interfaces to recording lo devices of agreed **contracts** .

A program step as used herein refers to instructions in a form executable or inferentially...

...6B depicts a refinement of Figure 3B of a market interval of an AC lo **power transfer** product type. The product type 1 1 1 0 of the market interval is furtherdescribedasanEnergyproducttypelll0...

...Figure 6C depicts a refinement of Figure 6B of a market interval of an AC **power transfer** product type. The product type 1 1 1 0 of the market interval is describedasanEnergyproducttypelll0. Thelocation1112isaflowgate of the **flow gate** collection of a first AC power network contained in the 2o electrical power grid. Note that **flow gates** can represent a congestion constraint across more than one transmission line, and may not have a specific first node to second node description.

Such embodiments of the invention of a **flow gate** market interval are advantageous in providing a market to trade transfer capability between 39 users. Because of the linear nature of AC **power transfer** throughout an AC **power** network, these **transfer** rights can be linearly accumulated to insure the **contracted** transfers are physically feasible in satisfying the overall flowgate constraints of the AC power network... networks indicates each AC power network contained in the electrical power grid further contains a **flow gate** collection of **flow gates** . Each **flow gate** location being either from an associated first node of the AC power network to an...

...in the case of a collection of constrained transmission lines, will be denoted by a **flow gate** designator. An AC **power transfer** amount from nodel to node2 produces an amount of AC **power transfer** across the **flow gate** as essentially an associated linear, skewsymmetric function of the amount from nodel to.node2, for each of the **flow gates** of the **flow gate** collection. For each of the□flow□ **gates** of the **flow gate** collection, there is at least one market interval in the market interval collection of AC **power transfer** product type with the **flow gate** location.

Each validated order of the validated order collection with the AC **power transfer** product type of the associated market interval may further contain an 41 amount. A validated order of AC **power transfer** product type from the first node to the second node may be further comprised of a validated order of the **flow gate** associated market interval. The amount ordered for that **flow gate** is essentially the associated linear, skew-symmetric function of the amount from the first node to the second node, for each of the **flow gates** of the **flow gate** collection.

Note that there may be a price associated with each validated order of the AC **power transfers** of the **flow gates** . There may be a price associated with the AC **power transfer** from the first node to the second node.
I
io Figure 8A depicts a market...

...second node of a second AC power network. The product type collection further comprises DC **power transfer** . For each DC power line of the DC

power line collection, there is at least one associated market interval with DC **power transfer** product type, with the location as the location of the DC power line.

Figure 8B...commodities.

Figure I OA depicts a detail flowchart of operation 2000 of Figure 4 performing **contracting** to create an agreed **contract** from the validated order collection.

Arrow 2090 directs the flow of execution from starting operation 2000 to io operation 2092. Operation 2092 performs **contracting** to create an agreed **contract** from the validated order collection. Arrow 2094 directs execution
from operation 2092 to operation 2096...

...fungible commodities.
Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from the validated order collection.

2o Arrow 2110 directs the flow of execution from starting...

...2118
directs execution from operation 2116 to operation 2120. Operation 2120 performs creating the agreed **contract** for the market interval at the agreed price for the agreed amount whenever the first...

...io Not all validated orders may have a price associated with them. Consider an
AC **power transfer** from nodel to node2 of an AC power network. Assume that AC power network has a collection of three **flow gates** . A validated order for an AC **power transfer** amount from nodel to node2 may contain validated orders for an associated amount for each **flow gate** of the **flow gate** collection.

Each of the **flow gate** validated orders may contain prices for their respective
flow gate . The agreed amount would be calculated based upon the associated amounts and pricing of the **flow gates** . Alternatively, all validated orders may have a price associated with them.

These operations may be...collection may be a member of a product type collection comprised of energy and AC **power transfer** . Thellocation of a market interval having an energy product type may be a first node...

...contained in the electrical power grid. The location of a market interval having an AC **power transfer** product type may be from a first lo node of a first AC power network...by the first party, to act on behalf of the first party with respect to **contracting** .

Server system 3500 includes at least one server computer 3520 coupled to network 3200. Network...

...various personal optimizations and
shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

Server system 3500 may include at least one server...

...operation 2092 of Figure 1 OA
performing notified biding and asking clients of the agreed **contract** for their respective validated orders.

52
Arrow 2270 directs the flow of execution from starting...

...2278
directs execution from operation 2276 to operation 2280. Operation 2280 performs sending a bid **contract** message based upon the agreed **contract** to the bid client. Arrow 2282 directs execution from operation 2280 to operation
2284. Operation 2284 performs sending an ask **contract** message based upon
lo the agreed **contract** to the ask client. Arrow 2286 directs execution from operation 2284 to operation 2288. Operation...

...the capacity option price, besides just price of
purchase. In agreeing to a capacity option **contract** , the seller is only guaranteed the earnings of the capacity option price, and the buyer...

...to buy the optioned capacity, it is
at the price already agreed upon in the **contract** . The seller then makes additional income from the actual purchased amount at the agreed price...
18C depicts a detail flowchart of operation 2120 of Figure 10B performing creating the agreed **contract** at the agreed price and the a'reed
9
option price for the agreed amount...

...of execution from starting operation 2120 to operation 2372. Operation 2372 performs creating the agreed **contract** for the market interval at the agreed price and the agreed option price for the...by the first party, to act on behalf of the first party with respect to **contracting** .

As shown in Figure 15, server system 3500 includes at least one server computer 3520...

...various
personal optimizations and shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

Server system 3500 may include at least one server...
...various
personal optimizations and shortcuts, including, but not limited to, macro style functions and standard **contract** forms employed by the client 3190.

io As shown in Figure 15, server system 3500...1998. The current market price in dollars per megawatt
hour 4010 is "12.96". The **contracted** position in net megawatts 4012 is io "12.00". The pending position in net megawatts...

...total position in net megawatts 4016 is "25.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net
megawatts-hours...

...market price in dollars per megawaft-hour 41 1 0 is "1 6.72". The

contracted position in net megawatts 4112 is "10.00". The pending position in net megawatts 4114...

...position in net megawatts 4116 is "l 0.00", which is the sum of the **contract** and pending positions for that market io interval. The highest bid quantity in net megawafts...
...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain embodiments of the invention.

The displayed information 4200 includes a variety of fields, including field 4202, where a specific **flow gate** or intertie may be selected. Immediately 2o below that field is a field which specifies...

...a succession of lo rows with entries from 1 to 24, indicating the hourly AC **power transfer** markets 4204 in the **flow gate** location "COCOPP Unit 1" 4202. Consider the row labeled by the hour 4208 ending at "3". This row displays the market state of the market interval with AC **power transfer** product type, **flow gate** 4202 location and hour time interval ending at 1:00 for May 10, 1999. The current market price in dollars per megawatt-hour 421 0 is "O.00". The **contracted** position in net megawatts 4212 is "O.00". The pending position in net megawatts 4214...

...total position in net megawatts 4216 is "O.00", which is the sum of the **contract** and pending positions for that market interval. The **contracted** flow 4224 is "O.00". The pending flow 4226 is "O.00".

2o The total...

8/KWIC/4 (Item 4 from file: 349)
DIALOG(R)File 349:(c) 2003 WIPO/Univentio. All rts. reserv.

Fulltext Availability:
Detailed Description

Detailed Description
... A bus locally connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network...that different transformers may have differing transformer capacity limits.

These constrained flow elements are called **flow gates** . In the last few years the importance of **flow gates** has begun to emerge through the actions of NERC, which has been responsible for building a model estimating **flow gate** impact, which can be downloaded from their web site.

io A **flow gate** of a given AC power network will refer herein to a collection of at least one line whose total **maximum** safe **carrying capacity** will act as a congested element of the network, constraining AC power delivery between two...

...of that network.

All lines have maximum safe carrying capacities and thus could be considered **flow gates** , of a sort. However, historical congestion analysis of specific AC power networks reveals that only a small number of **flow gates** account for almost all congestion problems. Such **flow gates** will be herein referred to as significant **flow gates** .

The associated AC **power transfer** across a given **flow gate** is additive due to
the super positioning effects previously discussed. Thus in sending 100 megawatts along a path, the transmission may have a 10% impact on the **flow gate** , putting 10 megawatts on the **flow gate** . A second generator may have a
5% impact on that **flow gate** . Generating 100 megawatt at the second generator would add 5 across the **flow gate** .

Figure 1 depicts an exemplary AC power network based upon contemporary AC power technology as...between node 100 and node 110. Line 112 runs between node 110 and node
120.

Flow gate A 210 is a constraint on the network. Lines 32, 34 and 42 are
constrained by **flow gate** A 210 by a total **maximum** safe□carrying□ **capacity** , in
that these lines have transmission **capacity** limitations which are easily
overloaded when this **maximum** safe **carrying capacity** is exceeded.

Flow gate B 220 is a constraint on the network. Lines 42 and 44 are constrained by **flow gate** B 220. These lines are also constrained by a total
maximum safe' **carrying capacity** due to system limitations, such as their
proximity at some critical junction of the system, such as a mountain pass.

Flow gate C 230 is a constraint on the network. Lines 52 and 62 are constrained by **flow gate** C 230 to a total **maximum** safe□carrying□ **capacity** .

Figure 2 depicts a list of associated AC power functions for each **flow gate** of a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...

...commodities or the economic results of transactions
involving ephemeral, fungible electrical commodities.

Consider how AC **power transfers** are managed today. Transmission rights
are considered and negotiated in terms of point-to-point transfers within the 2o network known as **contract** paths. Such thinking is contrary to the previously
discussed physics of these AC power networks...

...an essentially linear effect on all
transmission lines in the network, and consequently impact all **flow gates** within that network to some extent.

This **contract** path system of scheduling power transmission reserves transmission rights along a particular, direct path through...making up the direct path. It often occurs that some constraint, occurring across a significant **flow gate** off that direct path, actually limits the transmission capability on the direct path.

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SUDS I 1TUTE SHEET (RULE26)
The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.

Today's **contract** path is based upon a first-come, first-served priority scheme.

io What is bought...
...power transmission from A to B and bought a transmission from B to C. Using **contract** path approach, that does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning
power transmission from A to B and from B to...

...to
purchase separately transmission from A to C. This is because there might be some **flow gate** constraint which would not be met in the two separate paths
which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once the transmission from A to B is...

...the constraint, when a particular path becomes over-constrained, cuts are issued across apparently irrelevant **contracted**
paths to compensate. The central operator acts, because a **flow gate** will
overflow, forbidding transmission often across apparently irrelevant paths to compensate.

10
SUBSTITUTE SHEET (RULE226611...

...limited amount of detailed
information such a system can acquire, or use, to optimize AC **power transfers** . The **power** users are again blind to their options. The players
cannot determine what works best for...

...that could contribute to market efficiency and price stability.

NERC has developed a methodology addressing **flow gates** to some extent.

This is discussed in a document entitled "Discussion Paper on Aligning Transmission...

...shift to a system of reserving and scheduling transmission based on actual use of congested **flow gates** , which they called the FLOWBAT method. Their proposal suffers from a serious omission, it does not address the issue of allocating **flow gate** capacity when demand exceeds supply. By their silence on this issue, it appears that they... case called Transaction Participation Functions (TPFs). These distribution functions refer to transmission paths rather than **flow gates** .

GAPP attempts to align compensation paid by transmission users with actual power flows. However, GAPP is strictly an after-the-fact settlement system. It alters the current **contract** path scheme only to redistribute the revenue. It does not attempt to allocate scarce transmission...

...the physics of AC power networks. Further, since transmission rights are predominantly constrained by significant **flow gates** , what is needed should account for the effect on the significant **flow gates** for each **contracted** transmission. A method and mechanism is needed for planning the operations of devices and further support virtual trading in the ephemeral, fungible commodity and the incorporation of agreed **contracts** into the knowledge interval collection used to create the device operating schedule.

Certain further embodiments...

...further advantageously support virtual trading in the ephemeral, fungible commodity and the incorporation of agreed **contracts** into the knowledge interval collection used to create the device operating schedule. Note that the...the prior art; Figure 2 depicts a list of associated AC power functions for each **flow gate** of io a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...interval collection is a member of a product type collection comprised of energy and AC **power transfer** . In certain io further embodiments, the location of a market interval having an energy product...

...power grid. In certain further embodiments, the location of a market interval having an AC **power transfer** product type is from a first node of a first AC power network contained in...are not limited to acoustic interfaces to humans, audio and visual identification portals to the **contracting** of AC **power transfer** regarding **flow gates** , encoding and decoding mechanisms used in long distance communication and interfaces to recording devices of agreed **contracts** . A program step as used herein refers to instructions in a form that either by...

8/KWIC/5 (Item 5 from file: 349)

Fulltext Availability:

Claims

Claim
... wherein said program operating system contains a program code segment supporting contracting an AC power **transfer** on said AC power 2o network further comprising;
a program code segment supporting **contracting** an associated AC **power transfer** on each of said **flow gates** of said□flow gate□ collection.

53 A computing system of Claim 52,
wherein said program code segment supporting **contracting** for said AC **power transfer** on said AC power network further comprises;
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on
each of said **flow gates** of said **flow gate** collection; and
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights.

54 A computing system of Claim 53,
wherein each of said **flow gates** of said **flow gate** collection has an
associated **maximum** safe **carrying capacity** ; and
said program operating system further containing a program code segment supporting scheduling said AC **power transfer** for said agreed **contract**
comprising;
a program code segment supporting determining whether said associated AC **power transfer** of said **flow gate** of said□flow gate□ collection satisfies said associated **maximum** safe **carrying capacity** of said **flow gate** for each of said **flow**
gates of said **flow gate** collection; and
a program code segment supporting approving said AC **power transfer** whenever said associated AC **power transfer** of said **flow gate** satisfies said **maximum** safe **carrying capacity** for each said□flow□ **gates** of said **flow gate** collection.

55 A computing system of Claim 54, further comprised of:
a client computer collection...
...of said server computers of said server system; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises
a program code segment residing in said computer...

...received stimulus stream and said received server stream; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises;
57P
a program code segment supporting communicating via...delivery stream.

57 A computing system of Claim 56,
wherein said program code segment supporting **contracting** AC **power transfer** on said AC power network further comprises;
a program code segment supporting operating a virtual trading floor containing a market interval for trading AC **power transfer** for each of said **flow**

gates of said **flow gate** collection further comprising
a program code segment supporting transforming said received server
i o delivery...
...one bid order and at
least one ask order; and
a program code segment supporting **contracting** AC **power transfer** on
said AC power network to create an agreed **contract** based upon a first
of said bid orders of said order collection and based upon...

...collection comprising a bid type and an ask type;
wherein said program code segment supporting **contracting** said A C
power transfer on said AC power network to create an agreed **contract**
further
comprises;
a program code segment supporting **contracting** said AC **power transfer**
on said AC power network to create an agreed **contract** based upon a
first bid type order of said validated orders of said validated order...

...order collection.

59 A computing system of Claim 58,
wherein said program code segment supporting **contracting** for said A C
power transfer on said AC power network to create an agreed **contract**
by a first
party to own AC **power transfer** trading rights with associated AC
power
transfers on each of said **flow gates** of said□flow gate□
collection further comprises;
a program code segment supporting **contracting** for said AC **power**
transfer on said AC power network to create an agreed **contract** by a
first party to own AC **power transfer** trading rights with associated.
AC **power transfers** on each of said **flow gates** of said□flow□
gate collection based upon a first bid type order of said validated
orders of said validated...

...computing system of Claim 59. wherein at least one market interval is
associated with each **flow gate** of said **flow gate** collection.

61 A computing system of Claim 60,
wherein said server system is further comprised...

...amended, new claims 62-64 added, remaining claims
unchanged (1 3 pages)]
A method for **contracting** AC powe'r transfer on an AC power network with
a **flow gate** collection containing at least one **flow gate**
comprising:
contracting an AC **power transfer** on said AC power network to take
place
over a first time interval comprising:
contracting an associated AC **power transfer** on each of said□flow□
gates of said **flow gate** collection to take place over at least said
first time interval; and
contracting an AC **power transfer** collection of at least two AC
power
lo **transfers** on an AC power network further comprises:
contracting a sum of said associated AC **power transfer** for each of
said
AC **power transfers** of said AC **power transfer** collection on each
of said **flow gates** of said **flow gate** collection.

2 The method of Claim 62,
wherein **contracting** for AC **power** **transfer** on said AC power network comprises:
contracting for AC **power** **transfer** on said AC power network to take place
over a first time interval; and
wherein **contracting** said associated AC **power** **transfer** on each of said
flow **gates** of said **flow** **gate** collection comprises
contracting said associated AC **power** **transfer** on each of said□flow□ **gates**
of said **flow** **gate** collection to take place over at least said first time interval.

3 The method of Claim 2, further comprising:
co, rtrac ng an AC **power** **transfer** collection of at least two AC **power**
transfers on an AC power network further comprises
contracting a sum of said associated AC **power** **transfer** for each of said
AC **power** **transfers** of said AC **power** **transfer** collection on each
of said **flow** **gates** of said **flow** **gate** collection.

4 The method of Claim 1 9
wherein each **flow** **gate** of said **flow** **gate** collection has an associated
maximum safe **carrying** **capacity** ; and
wherein **contracting** said sum of said associated AC **power** **transfer** for
each of said AC **power** **transfers** of said AC **power** **transfer** collection on each of
said **flow** **gates** of said **flow** **gate** collection comprises
59
AMUENDED SHEET (ARTICLE 19)
said sum of said associated AC **power** **transfer** for each of said AC **power**
transfers of said AC **power** **transfer** collection satisfying said
associated **maximum** safe **carrying** **capacity** on each of said□flow□ **gates** of said **flow** **gate** collection.

5 The method of Claim 1,
wherein each of said AC **power** **transfers** of said AC **power** **transfer** collection is to take place over a first time interval; and
wherein **contracting** said sum of said associated AC **power** **transfer** for
each of said AC **power** **transfers** of said AC **power** **transfer** collection on ea ch of
said **flow** **gates** of said **flow** **gate** collection comprises
contracting each of said sum of said associated AC **power** **transfer** for each of said AC **power** **transfers** of said AC **power** **transfer** collection to take place Cat ...said first time interval.
6 The method of Claim 1,
wherein each of said AC **power** **transfers** of said AC **power** **transfer**
1 5 collection has an associated amount of energy from an associated first node of
said AC power network to a second node of said AC power network; and
wherein **contracting** said sum of said associated AC **power** **transfer** for
each of said AC **power** **transfers** of said AC **power** **transfer**

collection on each of
said **flow gates** of said **flow gate** collection comprises
contracting an amount of energy of said associated AC **power transfer**
on
each of said **flow gates** of said **flow gate** collection as
essentially an associated linear, skew-symmetric function of said
associated amount of energy...

...first node to said associated second node.

9 The method of Claim 1 9
wherein **contracting** for said AC **power transfer** on said AC power
network
comprises
contracting for said AC **power transfer** on said AC power network to
create an agreed **contract** by a first party to own AC **power transfer**
trading rights with associated AC **power transfers** on each of said
flow gates of said **flow gate**
collection; and
enabling said first party to further **contract** to sell said first party
owned A C **power transfer** trading rights.

11 The method of Claim 1 0,
wherein enabling said first party to further **contract** to sell said
first party
owned AC **power transfer** trading rights comprises
60
AMENDED SHEET (ARTICLE 19)
enabling said first party to further **contract** to sell said first party
owned A C **power transfer** trading rights before scheduling said AC
power transfer for said agreed **contract** .

13 The method of Claim 12,
wherein determining whether said associated AC **power transfer** of said
flow gate of said **flow gate** collection satisfies said associated
maximum safe **carrying capacity** of said□flow gate□for each of
said **flow gates** of said **flow gate**
collection further comprises
determining whether said associated AC **power transfer** of said **flow**
gate
i o of said **flow gate** collection satisfies said associated **maximum**
safe **carrying capacity** of said **flow gate** for each of said□flow□
gates of said **flow gate** collection
over said first time interval; and
wherein approving said AC **power transfer** whenever said associated A C
power transfer of said **flow gate** satisfies said□maximum□safe
carrying capacity for
i5 each said **flow gate** of said **flow gate** collection further
comprises
approving said AC **power transfer** over said first time interval
whenever
said associated AC **power transfer** of said **flow gate** satisfies
said **maximum** safe **carrying capacity** for each said□flow gates□of
said **flow gate** collection over said first time interval.

14 The method of Claim 13, further comprising:
contracting for an AC **power transfer** collection of at least one AC
power
transfer to create an agreed **contract** by a first party to own AC
power transfer trading rights with associated AC **power transfers**

on each of said **flow gates** of
said **flow gate** collection further compdses
contracting for a sum of associated AC **power transfers** for all AC **power**
transfers of said AC **power transfer** collection to create a **contract** for an associated AC **power transfer** for said collection of AC **power transfers** for each of said **flow gates** of said□flow□ **gate** collection.

15 The method of Claim 14,
wherein each of said AC **power transfers** of said AC **power transfer** collection has an associated amount of energy from an associated first node of
said AC power network to said second node of said AC power network;
wherein **contracting** for a sum of associated AC. **power transfers** for all A C **power transfers** of said AC **power transfer** collection to create a **contract** for an associated AC **power transfer** for said collection of AC **power transfers** for each
of said **flow gates** of said **flow gate** collection comprises
61
AMENDED SHEET (ARTICLE 19)
calculating said associated AC **power transfer** on said **flow gate** of said
AC **power transfer** as an amount of energy which is an essentially linear, skew
symmetric associated function of said amount of energy of said AC **power transfer** from said associated first node of said AC **power transfer** to said associated second node of said AC **power transfer** of each of said **flow gates** of said **flow gate** collection.

16 The method of Claim 9,
wherein enabling said first party to further **contract** to sell said first party
owned AC **power transfer** trading rights further comprises
I 0 enabling said first party to further **contract** to sell said first party owned A C **power transfer** trading rights for said associated AC **power transfer** for a first of said **flow gates** of said□flow gate□ collection.

17 The method of Claim 16,
wherein enabling said first party to further **contract** to sell said first party
1 5 owned AC **power transfer** trading rights further comprises
enabling said first party to further **contract** to sell said first party owned A C **power transfer** trading rights for said associated AC **power transfer** for each of said **flow gates** of said□flow gate□ collection.

23 The method of Claim 22, further comprising:
a first client user operating said...

...interactive status based upon said received stimulus stream and said received server stream; and
wherein **contracting** said AC **power transfer** on said AC power network further comprises
communicating via said network with said first client computer to create a received server delivery stream.

24 The method of Claim 23,
wherein **contracting** AC **power transfer** on said AC power network

further
comprises
62
AMENDED SHEET (ARTICLE 19)
operating a virtual trading floor containing a market for trading AC **power transfer** for each of said **flow gates** of said□flow gate□ collection further comprising transforming said received server delivery stream into an order collection
containing at least one bid order and at least one ask order, and **contracting** AC **power transfer** on said AC power network to create an agreed **contract** based upon a first of said bid orders of said order collection and based upon...

...with
program code segments contmcting AC power tmnsfer on an AC power network with a **flow gate** collection containing at least one **flow gate** , comprising:
a program code segment supporting **contracting** an AC **power transfer** on
said AC power network to take place over a first time interval comprising:
1 5 a program code segment supporting **contracting** an associated AC **power**
transfer on each of said **flow gates** of said□flow gate□ collection to take place over
at least said first time interval; and
a program code segment supporting **contracting** an AC **power transfer** collection of at least two AC **power transfers** on an AC power network to take
place over said first time interval further comprises:
a program code segment supporting **contracting** a sum of said associated AC **power transfers** for each of said AC **power transfers** of said AC **power**
transfer collection on each of said **flow gates** of said□flow gate□ collection to take place at least over at least said first time.

26 The program operating system of Claim 63,
wherein said program code segment supporting **contracting** an AC **power transfer** on said AC power network comprises
a program code segment supporting **contracting** an AC **power transfer** on
said AC power network to take place over a first time interval; and
wherein said program code segment supporting **contracting** said associated AC **power transfer** on each of said **flow gates** of said **flow gate** collection comprises
a program code segment supporting **contracting** said associated A C **power transfer** on each of said **flow gates** of said□flow gate□ collection to take place over at least said first time interval.

28 The program operating system of Claim 25,
63
AM[ENDED SHEET (ARTICLE 19)
wherein each **flow gate** of said **flow gate** collection has an associated
maximum safe **carrying capacity** ; and
wherein said program code segment supporting **contracting** said sum of said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection on each of said□flow□ **gates** of said **flow gate**

collection comprises
a program code segment supporting said sum of said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection satisfying said associated **maximum** safe **carrying capacity** on each of io said **flow gates** of said□flow□ **gate** collection.

29 The program operating system of Claim 27,
wherein each of said AC **power transfers** of said AC **power transfer** collection is to take place over a first time interval; and
wherein said program code segment supporting **contracting** said sum of 1 5 said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection on each of said□flow□ **gates** of said **flow gate**
collection comprises
a program code segment supporting **contracting** said sum of said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection to take place at least over at least said first time interval on each of said **flow gates** of said **flow gate** collection.

30 The program operating system of Claim 25,
wherein each of said AC **power transfers** of said AC **power transfer** collection has an associated amount of energy from an associated first node of
said AC...

...to a second node of said AC power network; and
said program code segment supporting **contracting** said sum of said associated AC **power transfer** for each of said AC **power transfers** of said A C **power transfer** collection on each of said **flow gates** of said **flow gate** collection
comprises
a program code segment essentially calculating an amount of energy of said associated AC **power transfer** on each of said **flow gates** of said **flow gate** collection as essentially an associated linear, skew-symmetric function of said associated amount of energy...

...node.

33 The program operating system of Claim 25,
wherein said program code segment supporting **contracting** for said A C **power transfer** on said AC power network further comprises
64
AMENDED SHEET (ARTICLE 19)
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on
each of said **flow gates** of said **flow gate** collection; and
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights.
34 The program operating system of Claim 33,
wherein each of said **flow gates** of said **flow gate** collection has an
associated **maximum** safe **carrying capacity** ; and
further comprising a program code segment supporting scheduling said AC **power transfer** for said agreed **contract** comprising
a program code segment supporting determining whether said associated

AC **power** **transfer** of said **flow** **gate** of said□flow gate□
collection satisfies said associated **maximum** safe **carrying** **capacity**
of said **flow** **gate** for each of said **flow**
i 5 **gates** of said **flow** **gate** collection; and
a program code segment supporting approving said AC **power** **transfer**
whenever said associated AC **power** **transfer** of said **flow** **gate**
satisfies said **maximum** safe **carrying** **capacity** for each said□flow□
gates of said **flow** **gate** collection.
2o 37. The program operating system of Claim 36,
wherein determining whether said associated AC **power** **transfer** of said
flow **gate** of said **flow** **gate** collection satisfies said associated
maximum safe **carrying** **capacity** of said□flow gate□for each of
said **flow** **gates** of said **flow** **gate**
collection further comprises
determining whether said associated AC **power** **transfer** of said **flow**
gate
of said **flow** **gate** collection satisfies said associated **maximum** safe
carrying **capacity** of said **flow** **gate** for each of said□flow□
gates of said **flow** **gate** collection
over said first time interval; and
wherein approving said AC **power** **transfer** whenever said associated A C
power **transfer** of said **flow** **gate** satisfies said□maximum□safe
carrying **capacity** for
each of said **flow** **gates** of said **flow** **gate** collection further
comprises
approving said AC **power** **transfer** over said first time interval
whenever
said associated AC **power** **transfer** of said **flow** **gate** satisfies
said **maximum** safe **carrying** **capacity** for each said□flow gates□of
said **flow** **gate** collection over said first time interval.

38 The program operating system of Claim 37, further comprising:
65
AM[ENDED SHEET (ARTICLE 19)
a program code segment supporting **contracting** for an AC **power**
transfer
collection of at least one AC **power** **transfer** to create an agreed
contract by a first
party to own AC **power** **transfer** trading rights with associated AC
power
transfers on each of said **flow** **gates** of said□flow gate□
collection further comprises
a program code segment supporting **contracting** for a sum of associated
AC **power** **transfers** for all AC **power** **transfers** of said AC□power□
transfer
collection to create a **contract** for an associated AC **power** **transfer**
for said collection of AC **power** **transfers** for each of said **flow**
gates of said **flow** **gate** collection.
I o 39. The program operating system of Claim 38,
wherein each of said AC **power** **transfers** of said AC **power** **transfer**
collection has an associated amount of energy from an associated first
node of
said AC...

...to said second node of said AC power network;
wherein a program code segment supporting **contracting** for a sum of
associated AC **power** **transfers** for all AC **power** **transfers** of said
AC **power** **transfer** collection to create a **contract** for an associated
AC **power** **transfer** for said collection of AC **power** **transfers** for
each of said **flow** **gates** of said **flow** **gate**

collection comprises
a program code segment calculating each of said associated AC **power transfers** on said **flow gate** of said AC□power transfer□has an amount of energy as an essentially linear, skew-symmetric function of said amount of energy from said associated first node to said associated second node of said AC **power transfer** of each of said **flow gates** of said **flow gate** collection.

40 The program operating system of Claim 33,
wherein said program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading fights
further comprises
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights for said 3o associated AC **power transfer** for a first of said **flow gates** of said **flow gate** collection.

41 The program operating system of Claim 40,
wherein said program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights
further comprises
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights for said
66
AMENDED SHEET (ARTICLE 19)
associated AC **power transfer** for each of said **flow gates** of said **flow gate** collection.

45 The program operating system of Claim 25,
wherein said computing system is further...

...of said server computers of said server
system; and
wherein said program code segment supporting **contracting** said AC **power transfer** on said AC power network further comprises
a program code segment residing in said computer...

...received stimulus stream and said received server stream; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises
a program code segment supporting communicating via said...

...stream.

47 The program operating system of Claim 46,
wherein said program code segment supporting **contracting** AC **power transfer** on said AC power network further comprises
67
AMENDED SHEET (ARTICLE 19)
a program code segment supporting operating a virtual trading floor containing a market interval for trading AC **power transfer** for each of said **flow**
gates of said **flow gate** collection further comprising
a program code segment supporting transforming said received server delivery stream into...

...one bid order and at

least one ask order, and
a program code segment supporting **contracting** AC power tmnsfer on said AC power network to create an agreed **contract** based upon a first of said bid orders of said order collection and based upon...
...collection.

49 The program operating system of Claim 48,
wherein supporting contmcting for said AC **power transfer** on said A C power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on each of said **flow**
1 5 **gates** of said **flow gate** collection further comprises
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on each of said **flow gates** of said□flow□ **gate** collection based upon a first bid type order of said validated orders of said validated...

...A computing system supporting program operating system of program code segments with program code segments **contracting** an AC **power transfer** on an AC power network with a **flow gate** collection containing at least one **flow**
gate , comprised of:
at least one computer, each of said computers in said computing system coupled...
...in said computing
system;
wherein said program operating system contains a program code segment supporting **contracting** an AC **power transfer** on said AC power
network further to take place over a first time interval comprising:
a program code segment supporting **contracting** an associated AC **power transfer** on each of said **flow gates** of said□flow gate□ collection to take place over
at least said first time interval; and

a program code segment supporting **contracting** an AC **power transfer** collection of at least two AC **power transfers** on an AC power network to take
place over said first time interval further comprises:
a program code segment supporting **contracting** a sum of said associated AC **power transfers** for each of said AC **power transfers** of said AC **power**
transfer collection on each of said **flow gates** of said□flow gate□ collection to take place at least over at least said first time.
53 A computing system of Claim 52,
wherein said program code segment supporting **contracting** for said AC i o **power transfer** on said AC power network further comprises
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on
each of said **flow gates** of said **flow gate** collection; and
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights.

54 A computing system of Claim 53,

wherein each of said **flow gates** of said **flow gate** collection has an
associated **maximum** safe **carrying capacity** ; and
said program operating system further containing a program code segment supporting scheduling said AC **power transfer** for said agreed contrad
comprising
a program code segment supporting determining whether said associated AC **power transfer** of said **flow gate** of said□flow gate□ collection satisfies said associated **maximum** safe **carrying capacity** of said **flow gate** for each of said **flow gates** of said **flow gate** collection; and
a program code segment supporting approving said AC **power transfer** whenever said associated AC **power transfer** of said **flow gate** satisfies said **maximum** safe **carrying capacity** for each said□flow□ **gates** of said **flow gate** collection.

56 A computing system of Claim 55,
wherein said program operating system further comprising...

...received stimulus stream and said received server stream; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises
a program code segment supporting communicating via said...

...i o 57. A computing system of Claim 56,
wherein said program code segment supporting **contracting** AC **power transfer** on said AC power network further comprises
a program code segment supporting operating a virtual trading floor containing a market interval for trading AC **power transfer** for each of said **flow**
i 5 **gates** of said **flow gate** collection further comprising
a program code segment supporting transforming said received server delivery stream into...

...one bid order and at
least one ask order, and
a program code segment supporting **contracting** AC **power transfer** on said AC power network to create an agreed **contract** based upon a first of said bid orders of said order collection and based upon...

...collection comprising a bid type and an ask type;
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network to create an agreed **contract** further
comprises
a program code segment supporting **contracting** said AC **power transfer**

on said AC power network to create an agreed **contract** based upon a first bid type order of said validated orders of ...order collection.

59 A computing system of Claim 58,
wherein said program code segment supporting **contracting** for said A C **power transfer** on said AC power network to create an agreed **contract** by a first
party to own AC **power transfer** trading rights with associated AC **power**
transfers on each of said **flow gates** of said□flow gate□ collection further comprises
70

AM[ENDED SHEET (ARTICLE 19)
a program code segment supporting **contracting** for said AC **power** **transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power** **transfer** trading rights with associated AC **power** **transfers** on each of said flow g ates of said **flow** **gate** -collection based upon a first bid type order of said validated orders of said validated...

...type order of said validated orders of said validated order collection.

62 A method for **contracting** AC **power** **transfer** on an AC power network with
a **flow** **gate** collection containing at least one **flow** **gate** comprising:
contracting an AC **power** **transfer** on said AC power network comprising
I 0 **contracting** an associated AC **power** **transfer** on each of said **flow** **gates** of said **flow** **gate** collection.

63 A program operating system executing on a computing system comprised of at least...

...said computing system coupled to an associated computer readable memory, supporting with
program code segments **contracting** AC **power** **transfer** on an AC power network with a **flow** **gate** collection containing at least one **flow** **gate** , comprising:
a program code segment supporting **contracting** an AC **power** **transfer** on
said AC power network comprising
a program code segment supporting **contracting** an associated AC **power** **transfer** on each of said **flow** **gates** of said□flow gate□ collection.

64 A computing system supporting program operating system of program code segments with program code segments **contracting** an AC **power** **transfer** on an AC power network with a **flow** **gate** collection containing at least one **flow** **gate** , comprised of:
at least one computer, each of said computers in said computing system coupled...

...in said computing
system;
wherein said program operating system contains a program code segment supporting **contracting** an AC **power** **transfer** on said AC power
network further comprising
a program code segment supporting **contracting** an associated AC **power** **transfer** on each of said **flow** **gates** of said□flow gate□ collection.
7 1
AMENDED SHEET (ARTICLE 19)
Amendment under Article 19 U1
Claims 62 to...

8/KWIC/6 **(Item 6 from file: 349)**
DIALOG(R)File 349:(c) 2003 WIPO/Univentio. All rts. reserv.

Fulltext Availability:
Detailed Description
Claims

Detailed Description
... A bus locally connects these local facilities of a node. High voltage AC transmission lines **transfer** **power** between the cities and the generators in major load centers of an AC power network...that different transformers may have differing transformer capacity limits.

These constrained flow elements are called **flow** **gates** . In the last few years the importance of **flow** **gates** has begun to emerge through the actions of NERC, which has been responsible for building a model estimating **flow** **gate** impact, which can be downloaded from their web site.

io A **flow** **gate** of a given AC power network will refer herein to a collection of at least one line whose total **maximum** safe **carrying** **capacity** will act as a congested element of the network, constraining AC power delivery between two...

...network.

All lines have maximum safe carrying capacities and thus could be considered 1 5 **flow** **gates** , of a sort. However, historical congestion analysis of specific AC power networks reveals that only a small number of **flow** **gates** account for almost all congestion problems. Such **flow** **gates** will be herein referred to as significant **flow** **gates** .

The associated AC **power** **transfer** across a given **flow** **gate** is additive due to the super positioning effects previously discussed. Thus in sending 100 megawatts along a path, the transmission may have a 1 0% impact on the **flow** **gate** , putting 10 megawatts on the **flow** **gate** . A second generator may have a 5% impact on that **flow** **gate** . Generating 100 megawatt at the second generator would add 5 across the **flow** **gate** . Figure I depicts an exemplary AC power network based upon contemporary AC power technology as...commodities or the economic results of transactions involving ephemeral, fungible electrical commodities.

Consider how AC power transfers are managed today. Transmission rights are considered and negotiated in terms of point-to-point transfers within the 2o network known as contract paths. Such thinking is contrary to the previously discussed physics of these AC power networks...

...an essentially linear effect on all transmission lines in the network, and consequently impact all **flow** **gates** within that network to some extent.

This **contract** path system of scheduling power transmission reserves transmission rights along a particular, direct path through...

...making up the direct path. It often occurs that some constraint, occurring across a significant **flow gate** off that direct path, actually limits the transmission capability on the direct path.
00
The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.

Today's **contract** path is based upon a first-come, first-served priority scheme.

io What is bought...

...power transmission from A to B and bought a transmission from B to C. Using **contract** path approach, that does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning 1 5 power transmission from A to B and from...
...to
purchase separately transmission from A to C. this is because there might be some **flow gate** constraint which would not be met in the two separate paths
which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once you have purchased the transmission from A...the constraint, when a particular path becomes over-constrained, cuts are issued across apparently irrelevant **contracted**
paths to compensate. The central operator acts, because a **flow gate** will
overflow, forbidding transmission often across apparently irrelevant paths to compensate.

Another alternative approach is...

...limited amount of detailed
information such a system can acquire, or use, to optimize AC **power transfers** . The **power** users are again blind to their options. The players
cannot determine what works best for...
...to imagine that such a situation could be optimal.

NERC has developed a methodology addressing **flow gates** to some extent.

3o This is discussed in a document entitled "Discussion Paper on Aligning ...

...shift to a system of reserving and scheduling transmission based on actual use of congested **flow gates** , which they called the FLOWBAT method. Their proposal suffers from a serious omission, it does not address the issue of allocating **flow gate** capacity when demand exceeds supply. By their silence on this issue, it appears that they...

...case called Transaction Participation Functions (TPFs).

These distribution functions refer to transmission paths rather than **flow gates** .

GAPP attempts to align compensation paid by transmission users with actual power flows. However, GAPP is strictly an after-the-fact settlement system. It 2o alters the current **contract** path scheme only to redistribute the revenue. It does not attempt to allocate scarce transmission...

...the physics of AC power networks. Further, since transmission rights are predominantly constrained by significant **flow gates** , what is needed should account for the effect on the significant **flow gates** for each **contracted** transmission. A method and mechanism is needed for trading generation and transmission rights in a...

...market interval time interval.

The product type of a market interval includes energy and AC **power transfer** .

2o The location of a market interval with an energy product type is a node...

...an AC power network node collection. The location of a market interval with an AC **power transfer** product type is from a first node ...further embodiments include an AC power network in the electrical power grid further containing a **flow gate** collection. For each **flow gate** of the **flow gate** collection, there is at least one market interval with AC **power transfer** product type and location of the **flow gate** . Such embodiments advantageously provide a trading mechanism for AC **power transfers** across **flow gates** , which is in keeping with the physical characteristics of AC power networks. Note that again, each of these market intervals are markets for ephemeral, fungible commodities, AC **power transfer** effects across a **flow gate** during a time interval.

io Certain other further embodiments includes electrical power grids further containing...

...second node of a second AC power network. The product type collection further includes DC **power transfers** . Market intervals with DC **power transfer** product types have locations the same as the DC power line. Such embodiments advantageously provide market for additional ephemeral, fungible commodities, DC **power transfers** over specific DC power lines during specific time intervals.

Certain embodiments include where each market...

...removing trading in market intervals which pass outside their window time interval.

Certain embodiments include **contracting** to create an agreed **contract** from the validated order collection. **Contracting** to create an agreed **contract** from the validated order collection further includes determining a first bid validated 1 5 order...

...terms of price to create an agreed price; calculating an agreed amount; creating the agreed **contract** for the first market interval at the agreed price for the agreed amount with first bid validated order and first ask validated order. Such embodiments advantageously support forming **contracts** based upon the validated orders of the virtual trading floor for the ephemeral, fungible commodities...
...and asks which are no longer active, since they have become bound by the agreed **contract** .

Certain further embodiments include removing the first bid validated order from a validated order containing...

...collection from order messages received from certified clients.

Certain further embodiments advantageously include extension of **contracting** to create an agreed **contract** from the validated order collection to include sending the ordering clients of the first bid validated order and the first ask validated order notice of the agreed **contract** .

Certain embodiments advantageously include extension of maintaining the market collection of market intervals to include...terms of price further includes calculating in terms of capacity option price. Creating the agreed **contract** for the market interval at the agreed price for the agreed amount includes the agreed capacity option price. Such embodiments advantageously provide for capacity option **contracting** of ephemeral, fungible commodities in the electrical power grid.

io In certain further embodiments, for...

...Figure 6B depicts a refinement of Figure 3B of a market interval of an AC **power transfer** product type in accordance with certain embodiments; Figure 7 depicts a validated order 1200 comprised...

...has passed;
Figure 10A depicts a detail flowchart of operation 2000 of Figure 4 performing **contracting** to create an agreed **contract** from said validated order collection;
Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from said validated order 1 5 collection;
Figure 11 A depicts a detail flowchart of...operation 2092 of Figure 1 OA performing notified biding and asking clients of the agreed **contract** for their respective validated orders;
Figure 17A depicts a detail flowchart of operation 2004 of...
...18C depicts a detail flowchart of operation 2120 of Figure 10B performing creating the agreed **contract** at the agreed price and the agreed io option price for the agreed amount whenever...

...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain embodiments.

Detailed Description of the Invention
Figure 3A depicts a...

...interval collection is a member of a product type collection comprised of energy and AC **power transfer** . In certain
@/ z
further embodiments, the location of a market interval having an energy product...

...power grid. In certain further embodiments, the location of a market interval having an AC **power transfer** product type ...are not limited to acoustic
interfaces to humans, audio and visual identification portals to the **contracting**
of AC **power transfer** regarding **flow gates** , encoding and decoding mechanisms used in long distance communication and interfaces to recording devices of agreed **contracts** .

A program code segment as used herein refers to instructions in a form executable or...Figure 6B depicts a refinement of Figure 3B of a market interval of an AC
power transfer product type in accordance with certain embodiments. The
product type 1110 of the market interval...

...Figure 6C depicts a refinement of Figure 6B of a market interval of an AC
power transfer product type in accordance with certain embodiments. The
product type 1 1 1 0 of...

...an Energy product type 1 1 1 0. The location 1 1 12 is a **flow gate** of the **flow gate** collection of a first AC power network contained in the electrical power grid. Note that **flow**
gates can represent a congestion constraint across more than one transmission line, and may not have...
...networks indicates each AC power network contained in the electrical power grid further contains a **flow gate** collection of **flow gates** . Each **flow gate** location being either from
an associated first node of the AC power network to an...

...in the case of a collection of constrained transmission lines, will be denoted by a **flow gate** designator. An AC **power**
transfer amount from nodel to node2 produces an amount of AC **power transfer** across the **flow gate** as essentially an associated linear, skewsymmetric function of the amount from nodel to nodeZ for each of the **flow gates** of the **flow gate** collection. For each of the□flow□ **gates** of the **flow gate** collection, there is at least one market interval in the market interval collection of AC **power transfer** product type with the **flow gate** location.

In certain embodiments, each validated order of the validated order collection io with the AC **power transfer** product type of the associated market interval further contains an amount. In certain further embodiments, a validated order of AC **power transfer** product type from the first node to the second node is further comprised of a validated

order of the **flow gate** associated market interval. The amount ordered for that **flow gate** is essentially the associated linear, skew-symmetric function of the amount from the first node to the second node, for each of the **flow gates** of the **flow gate** collection.

Note that in certain further embodiments, there is a price associated with each validated order of the AC **power transfers** of the **flow gates** . In certain further embodiments, there is a price associated with the AC **power transfer** from the first node to the second node.

Figure 8A depicts a market interval of...

...second node of a second AC power network. The product type collection further comprises DC **power transfer** . For each DC power line of the DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with the location as the location of the DC power line.

2115
Figure...

...commodities.
Figure 10A depicts a detail flowchart of operation 2000 of Figure 4 performing io **contracting** to create an agreed **contract** from the validated order collection.

Arrow 2090 directs the flow of execution from starting operation 2000 to operation 2092. Operation 2092 performs **contracting** to create an agreed **contract** from the validated order collection. Arrow 2094 directs execution
from operation 2092 to operation 2096...

...commodities.

2o Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from the validated order collection.

Arrow 2110 directs the flow of execution from starting operation...

...1
directs execution from operation 2116 to operation 2120. Operation 2120 performs creating the agreed **contract** for the market interval at the agreed price for the agreed amount whenever the first...
...certain embodiments, not all validated orders have a price associated with
them. Consider an AC **power transfer** from nodel to node2 of an AC power
network. Assume that AC power network has a collection of three **flow gates** .

io A validated order for an AC **power transfer** amount from nodel to node2 may contain validated orders for an associated amount for each **flow gate** of the
flow gate collection. Each of the **flow gate** validated orders may contain
prices for their respective **flow gate** . The agreed amount would be calculated based upon the associated amounts and pricing of the **flow gates** . In certain 1 5 other embodiments, all validated orders have a

price associated with them...interval collection is a member of a product type collection comprised of energy and AC **power transfer** . In certain further embodiments, the location of a market 1 5 interval having an energy...

...power grid. In certain further embodiments, the location of a market interval having an AC **power transfer** product type is from a first node of a ...by the first party to act on behalf of the first party with respect to **contracting** the AC **power transfer** .

Server system 3500 includes at least one server computer 3520 coupled to network 3200. Network...

...various personal
optimizations and shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

In certain other further embodiments, server system 3500 includes...

...operation 2092 of Figure 1 OA
performing notified biding and asking clients of the agreed **contract** for their respective validated orders.

Arrow 2270 directs the flow of execution from starting operation...

...2278
directs execution from operation 2276 to operation 2280. Operation 2280 performs sending a bid **contract** message based upon the agreed **contract** to the bid client. Arrow 2282 directs execution from operation 2280 to operation
2284. Operation 2284 performs sending an ask **contract** message based upon
the agreed **contract** to the ask client. Arrow 2286 directs execution from
operation 2284 to operation 2288. Operation...the capacity option price, besides just price of purchase. In agreeing to a capacity option **contract** , the seller is only guaranteed the earnings of the capacity option price, and the buyer...

...the optioned capacity, it is at the price already agreed upon in the 1 5 **contract** . The seller then makes additional income from the actual purchased amount at the agreed price...

...18C depicts a detail flowchart of operation 2120 of Figure 10B performing creating the agreed **contract** at the agreed price and the agreed option price for the agreed amount whenever the...

...of execution from starting operation 2120 to
operation 2372. Operation 2372 performs creating the agreed **contract** for the market interval at the agreed price and the agreed option price for the...by the first party to act on behalf of the first party with respect to **contracting** the AC **power transfer** .

As shown in Figure 1 5, server system 3500 includes at least one server computer...

...various
personal optimizations and shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

In certain other further embodiments, server system 3500 includes... various personal optimizations and shortcuts, including, but not limited to,
macro style functions and standard **contract** forms employed by the client
3190.

As shown in Figure 15, in certain other further...1998. The current market price in dollars per megawatt
hour 4010 is "12.96". The **contracted** position in net megawatts 4012 is "12.00". The pending position in net megawatts 4014...
...5 position in net megawatts 4016 is "25.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net
megawatts-hours...

...market price in dollars per megawatt-hour 41 1 0 is 1 6.72". The **contracted** position in net megawatts 4112 is "1 0.00". The pending position in net megawatts...

...position in net megawatts 4116 is 1 0.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...

...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain embodiments.

The displayed information 4200 includes a variety of fields, including field 4202, where a specific **flow gate** or intertie may be selected. Immediately below that field is a field which specifies commodity...

...has a succession of
rows with entries from 1 to 24, indicating the hourly AC **power transfer**
markets 4204 in the **flow gate** location "COCOPP Unit 1" 4202. Consider the row labeled by the hour 4208 ending at "3". This row displays the market state of the market interval with AC **power transfer** product type, **flow gate** io 4202 location and hour time interval ending at 1:00 for May 10, 1999. The
current market price in dollars per megawatt-hour 4210 is "O.00". The **contracted** position in net megawatts 4212 is "O.00". The pending position in net megawatts 4214...

...total position in net megawatts 4216 is "O.00", which is the sum of the **contract** and pending positions for that market interval. The **contracted** flow 4224 is "O.00". The pending flow 4226 is "O.00".

The total flow...

Claim
... interval collection is a member of a product type collection comprised of energy and AC **power transfer** ;
wherein said location of a market interval of said market interval collection having said energy...

...wherein said location of a market interval of said market interval collection having said AC **power transfer** energy product type is from a first of said nodes of said node collection of...

...2,
wherein an AC power network contained in said electrical power grid further contains a **flow gate** collection of **flow gates** , each□flow□ **gate** location
being from an associated first node of said AC power network to an associated second node of said AC power network;
wherein for each of said **flow gates** of said **flow gate** collection, there is at least one associated market interval in said market interval collection of AC **power transfer** product type with said **flow gate** location.
4 The method of Claim 1,
wherein said electrical power grid further contains a...

...a second AC
1 5 power network;
wherein said product type collection further comprises DC **power transfer** ; and
wherein for each DC power line of said DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with said location as said location of said DC power line.

5 The...

...market interval of said validated order.
2o 8. The method of Claim 1, further comprising
contracting to create an agreed **contract** from said validated order collection comprising
determining a first bid validated order associated with a...

...said first bid validated order and first ask validated order; and
56
creating said agreed **contract** for said first market interval at said agreed price for said agreed amount whenever said...upon said first bid validated order and first ask validated order;
wherein creating said agreed **contract** for said market interval at said 2o agreed price and said agreed option price for said agreed amount includes
creating said agreed **contract** for said market interval at said agreed price and said agreed option price for said...

...order client contained in said validated order collection.

13 The method of Claim 12,
wherein **contracting** to create said agreed **contract** from said validated
order collection further comprises
extracting from said first bid validated order to...

...extracting from said ask validated order to create an ask certified client;
sending a bid **contract** message based upon said agreed **contract** to said bid client;
sending an ask **contract** message based upon said agreed **contract** to said ask client.

14 The method of Claim 8,
wherein each of said market...

...interval collection is a member of a product type collection comprised of energy and AC **power transfer** ;
wherein said location of a market interval of said market interval collection having said energy...

...wherein said location of a market interval of said market interval collection having said AC **power transfer** energy product type is from a first 3o node of said node collection of a...

...18,
wherein an AC power network contained in said electrical power grid further contains a **flow gate** collection of **flow gates** , each□flow□ **gate** location
being from an associated first node of said AC power network to an associated second node of said AC power network;
wherein for each of said **flow gates** of said **flow gate** collection, there is at least one associated market interval in said market interval collection of AC **power transfer** product type with said **flow gate** location.

20 The program operating system of Claim 17,
wherein said electrical power grid further...

...node of a second AC
power network;
wherein said product type collection further comprises DC **power transfer** ; and
wherein for each DC power line of said DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with said location as said location of said DC power line.

21 The...

...24 The program operating system of Claim 17, further comprising
a program code segment supporting **contracting** to create an agreed **contract** from said validated order collection comprising:
61
a program code segment supporting determining a first...
...validated order and first ask validated order;
a program code segment supporting creating said agreed **contract** for said first market interval at said agreed price for said agreed amount io whenever...

...2o 29. The program operating system of Claim 28,
wherein said program code segment supporting **contracting** to create an agreed **contract** from said validated order collection further comprises
a program code segment supporting extracting from said...

...order to create an ask certified client;
a program code segment supporting sending a bid **contract** message based upon said agreed **contract** to said bid client; and
a program code segment supporting sending an ask **contract** message 3o based upon said agreed **contract** to said ask client.
6@
. The program operating system of Claim 24,
wherein each of...interval collection is a member of a product type collection
comprised of energy and AC **power transfer** ;
wherein said location of a market interval of said market interval

collection having said energy...

...wherein said location of a market interval of said market interval collection having said AC **power transfer** energy product type is from a first node of said node collection of a first...

...34,
wherein an AC power network contained in said electrical power grid further contains a **flow gate** collection of **flow gates** , each□flow□ **gate** location
being from an associated first node of said AC power network to an associated second node of said AC power network;
wherein for each of said **flow gates** of said **flow gate** collection, there is at least one associated market interval in said market interval collection of AC **power transfer** product type with said **flow gate** location.

36 The computing system of Claim 33,
wherein said electrical power grid further contains...

...node of a second AC
power network;
wherein said product type collection further comprises DC **power transfer** ; and
wherein for each DC power line of said DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with said location as said location of said DC power line.

37 The...of Claim 33,
wherein said program operating system further comprises
a program code segment supporting **contracting** to create an agreed **contract** from said validated order collection comprising;
a program code segment supporting determining a first bid...

...order and first ask validated order; and
a program code segment supporting creating said agreed **contract** for said first market interval at said agreed price for said agreed amount
69
whenever...

...maintaining said validated
order collection of said validated orders; and
said program code segment supporting **contracting** to create an agreed **contract** from said validated order collection.
io 48. The computing system of Claim 47,
wherein said segment supporting **contracting** to create an agreed **contract** from said validated order collection.
2o 49. The computing system of Claim 48,
wherein said...

...computer system.

50 The computing system of Claim 44,
wherein said program code segment supporting **contracting** to create said agreed **contract** from said validated order collection further comprises:
a program code segment supporting extracting from said...

...order to create an ask certified client;
a program code segment supporting sending a bid **contract** message

based upon said agreed **contract** to said bid client; and
a program code segment supporting sending an ask **contract** message
based upon said agreed **contract** to said ask client.

51 The computing system of Claim 44,
wherein each of said...
...validated order and first ask validated
order;
said program code segment supporting creating said agreed **contract**
for said market interval at said agreed price and said agreed option
price for
io said agreed amount includes
said program code segment supporting creating said agreed **contract**
for said market interval at said agreed price and said agreed option
price for
said...
?

T S8/KWIC/1-6

8/KWIC/1 (Item 1 from file: 349)

Fulltext Availability:
Detailed Description
Claims

Detailed Description
... of transmitting electrical power, particularly AC electrical power has significant congestion paths, known herein as **flow gates** .

There has been little economic incentive to increase the transmission capacity through the **flow gates** , in part because there is no coherent policy provided fair and predictable economic return to...

...energy industry brought many things with it, including a restriction to only short-term energy **contracts** . As the older, long term **contracts** ended, this left the bulk of the state's energy costs vulnerable to daily market...load. A bus connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network...change. The National Electric Reliability Council computes a system of a set of numbers -called **power transfer** distribution factors available on the North American Reliability Council website, www.nerc.com, showing how...AC power network refers herein to a collection of at least one line whose total **maximum** safe **carrying capacity** acts as a congested element of the network, constraining AC power delivery between two ...referred to as significant flowgates. Path15 is io considered a significant flowgate.

The associated AC **power transfer** across a given flowgate is additive due to the super positioning effects previously discussed. Thus...Lines 32, 34 and 42 are io constrained by flowgate A 210 by a total **maximum** safe **carrying capacity** , in that these lines have transmission **capacity** limitations which are easily overloaded when this **maximum** safe **carrying capacity** is exceeded.

Flowgate B 220 is a constraint on the network. Lines 42 and 4...the network. Lines 52 and 62 are constrained by flowgate C 230 to a total **maximum** safe **carrying capacity** .
By way of example, a mountain range such as the Cascade mountain range in the...the values in
1 1
the first row of Figure 2 indicate the ratio of **power transferred** across flowgates A, B, and C. If the power is ...at Bus 1 , the same values apply but are of reversed sign.

Consider how AC **power transfers** are managed today in most of North Americа. Transmission rights are considered and negotiated in terms of pointto-point transfers within the network known as **contract** paths. Such thinking is contrary to the previously discussed physics of these AC power networks **contract** path system maintains the fiction that AC power

can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with, the **contract** path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.
Today's **contract** path is a first-come, first-served priority scheme. What is 2o bought has very...

...transmission from A to B and bought a transmission from B to C. Using the **contract** path approach, does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning
power transmission from A to B and from B to...the two separate paths which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once you have purchased the transmission from AThese **contract** path approaches
ignore the physics of AC power networks. This leads to situations where even...solution that is based upon the power distribution matrix. This is a matrix of all **power** **transfer** distribution factors between nodes of the AC power network.

This approach suffers from at least...

...limited amount of detailed information such a system can acquire, or use, to optimize AC **power** **transfers** . The **power** users are again blind to their options. The players
cannot determine what works ...large
numbers of flowgates and providing users with a straightforward method of trading the AC **power** **transfer** , while discouraging gaming opportunities.

io What is needed is a system supporting trading transmission rights potential flowgate
right and providing users with straightforward trading mechanisms for AC **power** **transfer** . Such trading mechanisms insure compliance with flowgate
constraints, and thus the physics of AC power...of trading fungible, ephemeral
commodities, including, but not limited to, DC and AC electricity, AC **power** **transfers** , flowgate rights, and point-to-point AC **power** **transfer** rights with bundled flowgate transmission rights.

is
The invention advantageously provides a seamless integration from...
Figure 7B depicts a refinement of Figure 3B of a market interval of an AC **power** **transfer** product type;
Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power** **transfer** product type;
Figure 7D depicts a refinement of Figures 7B and 7C of a market interval of
an AC **power** **transfer** point- ...by the first party, to act on behalf of the first party with respect to **contracting** .

Server system 3500 includes at least one server computer 3520 coupled to io network 3200...various personal optimizations and shortcuts,

including, but not limited to, macro style functions and standard **contract** forms employed by the ...collection may be a member of a product type collection comprised of energy and AC **power transfer** . The location of a market interval having an energy product type may 2o be a...

...contained in the electrical power grid. The location of a market interval having an AC **power transfer** product type may be from a first node of a first AC power network contained...one month.

A lot is the quantity in multiples of which an order must be **contracted** .

2o A basic function of a market segment is to match ...7B depicts a refinement of Figure 3B of a market interval of an AC io **power transfer** product type. The product type 1110 of the market interval is further described as an...Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power transfer** product type. The product type 1 1 1 0 of the market interval is describedasanEnergyproducttypelIlO...market to trade transfer capability between
70
users. Because of the linear nature of AC **power transfer** throughout an AC **power** network, these **transfer** rights can be linearly accumulated to insure the **contracted** transfers are physically feasible in satisfying the overall flowgate constraints of the AC power network.

...depicts a refinement of Figures 7B and 7C of a market interval of an AC **power transfer** point-to-point product type. The product type 1 1 1 6 of
the market...second node of
the first AC power network. However, a market interval for an AC **power transfer** point-to-point product type further possesses all the ancillary flowgate transmission rights required for...liquidity, participants should be very
comfortable posting bids and offers for point-to-point AC **power transfer** rights, since they constitute complete products from a participant perspective.

71
Bids for AC **power transfer** point-to-point market intervals are comprised of bids'-for at least one flowgate transmission right sharing the same location.

Bids for AC **power transfer** point-to-point market intervals may further
comprise bids for each of the flowgates of the flowgate collection sharing the same location. Bids for AC **power transfer** point-to-point market intervals may further comprise transmission rights for at least one flowgate...a collection of constrained transmission lines, will be denoted by a flowgate designator. An AC **power transfer** amount from nodel to node2 produces an amount of AC **power transfer** across the flowgate as essentially an associated linear, skew symmetric function of the amount from is at least one market interval in the market interval collection of AC **power transfer** product type with the flowgate'location.

73
Each validated order of the validated order collection with the AC **power**

transfer product type of the associated market interval may further contain an amount. A validated order of AC **power** **transfer** product type from the first node to the second node may be further comprised of ...that there may be a price associated with each validated order of the AC io **power** **transfers** of the flowgates. There may be a price associated with the AC **power** **transfer** from the first node to the second node.

Figure 9A depicts a market interval of...second node of a second AC power network. The product type
collection further comprises DC **power** **transfer** . For each DC power line of the DC power line collection, there is at least one associated market interval with DC **power** **transfer** product type, with the location as the location of the DC power line.

Figure 9B...1998. The current market price in dollars per megawatt hour 7010 is "12.96". The **contracted** position in net megawatts 7012 is "12.00". The pending position in net megawatts 7014which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net
megawatts-hours...7102.
The current market price in dollars per megawatt-hour 7110 is "16.72". The **contracted** position in net megawatts 7112 is 1 0.00". The pending position in i5 net...

...position in net megawatts 7116 is "l 0.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...has a succession
of rows with entries from 1 to 24, indicating the hourly AC **power** **transfer** markets 7204 in the flowgate location "Flowgate-a" 7202. Consider the row labeled by the...

...ending at "V. This row displays the market state of
the market interval with AC **power** **transfer** product type, flowgate 7202
location and hour time interval ending at 1:00 for May...

...1999. The current
market price in dollars per megawatt-hour 7210 is "O.00". The **contracted**

position in net megawatts 7212 is "O.00". The pending position in ...
total position in net megawatts 7216 is "O.00", which is the sum of the **contract** and pending positions for that market interval.
The **contracted** flow 7224 is "O.00". The pending flow 7226 is "O.00". The
total flow...the source generation, transmission rights and
destination loading, where applicable, which preferably becomes a single **contract** . This creates a fundamental simplification in the conceptual effort required to trade energy delivery.

Figure...of Figure 26.

Note that at least one of the market intervals contains an AC **power** **transfer** product type as the fungible, ephemeral commodity and contains the location as a first of...each be further based upon the flowgate collection.

The market interval may contain the AC **power** **transfer** product type as the fungible, ephemeral commodity and further, the market interval may contain an AC **power** **transfer** point-to-point product type as the

fungible, ephemeral commodity.

Figure 28A depicts a detail...contained in the flowgate collection, at least one of the market intervals contains the AC **power transfer** product type as the fungible, ephemeral commodity and the location coinciding with the flo'wgate...

Claim
... of Claim 1 1,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral ...contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...The system of Claim 13,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.
114
. The system of Claim...the program steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate...amount, and a price;
an ask specification containing said amount, and said price; and
an **contract** specification containing said amount and said price;
wherein the program step managing said market trade...method of Claim 41,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
127
said location as a first one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...The method of Claim 43,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.

45 The method of Claim...including the steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate...system of Claim 74,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
said location as a first of...contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said fiowgate entry...

...The system of Claim 76,

wherein said product type is further comprised of an AC **power transfer**

io point-to-point product type as said fungible, ephemeral commodity.

78 The system of...including:
a means for generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least ...system of Claim 109,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
said location as a first of...contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...said flowgate collection.
112. ThesystemofClaim111,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.
113. ThesystemofClaim112,
158
wherein the...including the steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate lo entry, for at least one...of Claim 143,
wher ein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
said location as a first of...contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry...

...The method of Claim 145,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral ...including the steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding ... contained in said flowgate
collection, at least one of said market intervals contains said AC **power transfer** product type as said fungible, ephemeral commodity and said location
coinciding with ...The system of Claim 178,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.
180. The system of Claim...including:
a means for generating a bid associated with said market interval containing said AC **power transfer** product type and said location
coinciding with said flowgate entry, for at least one flowgate...

8/KWIC/2 (Item 2 from file: 349)
DIALOG(R)File 349:(c) 2003 WIPO/Univentio. All rts. reserv.

Fulltext Availability:
Detailed Description
Claims

English Abstract
...for the new bundles exceeds the aggregate offers for the old bundles, the optimization system **contracts** orders for the bundles and performs the disassembly and reassembly. The invention provides a participant...

...quote attractive places an order at any time and is assured that the order will **contract** at the quoted price.

Detailed Description
... of transmitting electrical power, particularly AC electrical power has significant congestion paths, known herein as **flow gates** . There has been little economic incentive to increase the transmission capacity through the **flow gates** , in part because there is no coherent policy provided fair- and predictable economic return to...

...energy industry brought many things with it, including a restriction to only short-term energy **contracts** . As the older, long term **contracts** ended, this left the bulk of the state's energy costs vulnerable to daily market...load. A bus connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network...change. The National Electric Reliability Council computes a system of a set of numbers called **power transfer** distribution factors available on the North American
Reliability Council website, www.nerc.com, showing how...C power network refers herein to a collection of at least one line whose total **maximum** safe **carrying capacity** acts as a congested element of the ...herein referred to as significant flowgates. Path15 is considered a significant flowgate.

The associated AC **power transfer** across a given flowgate is additive due to the super positioning effects previously discussed. Thus...Lines 32, 34 and 42 are
constrained by flowgate A 21 0 by a total **maximum** safe **carrying capacity** , in that these lines have transmission **capacity** limitations which are easily overloaded when this **maximum** safe **carrying capacity** is ...the network. Lines 52 and 62 are constrained by flowgate C 230 to a total **maximum** safe **carrying capacity** .
6
By way of example, a mountain range such as the Cascade mountain range in ...1 1 , the values in the first row of Figure 2 indicate the ratio. of **power transferred** across flowgates A, B@ and C. If the power is generated at Bus 1 1...

...at Bus 1, the same values apply but are of reversed sign.

Consider how AC **power transfers** are managed today in most of North Arnerca.

Transmission rights are considered and negotiated in terms of point-to-point transfers within the network known as **contract** paths.

Such thinking is contrary to
the previously discussed physics of these AC power networks...in the network, and consequently impact all flowgates within that network to some extent.

The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because a was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** path approach is that
8
the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.

Today's **contract** path is a first-come, first-served priority scheme. What is bought has very limited...

...transmission from A to B and bought a transmission from B to C. Using the **contract** path approach, does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning
power transmission from A to B and from B to...

...approaches to limiting flow on one path because
of the impact on another path. These **contract** path approaches ignore the
physics of AC power networks. This leads ...is based upon the power distribution matrix. This is a 1 0 matrix of all **power transfer** distribution factors between nodes of the AC power network.

This approach suffers from at least...

...limited amount of detailed information such a system can acquire, or use, to optimize AC **power transfers** . The **power** 1 5 users are again blind to their options. The players cannot determine what works...numbers of flowgates and providing users with a straightforward method of trading the A C **power transfer** , while discouraging gaming opportunities.

What is needed is a system supporting trading transmission rights and...

...flowgate right, and potential flowgate right and providing users with straightforward trading mechanisms for AC **power transfer** . Such trading ...for the new bundles exceeds the aggregate offers for the old bundles, the optimization system **contracts** orders for the bundles and performs the disassembly and reassembly.

The invention provides a participant...quote attractive places an order at any time and is assured that the order will **contract** at the quoted price.
Participants can therefore negotiate energy deals on any terms they wish ...Figure 7B depicts a refinement of Figure 3B of a market interval of an AC **power**
transfer product type;
Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power**
transfer product type;
Figure 7D depicts a refinement of Figures 7B and 7C of a market interval

of an
AC **power** **transfer** point-to-point product type;
Figure 8 depicts a validated order 1200 comprised of at...by the first party, to act on behalf of the first party with respect to **contracting** .

Server system 3500 includes at least one server computer 3520 coupled to network 3200. Network...various personal optimizations and shortcuts, including, but not limited to, macro style functions and standard **contract** forms employed by the client 1400.

Server system 3500 may include at least one server...collection may be a member of a
product type collection comprised of energy and AC **power** **transfer** . The
...contained in the electrical power grid.

The location of a market interval having an AC **power** **transfer** product type may be from a first node of a first AC power network contained...one month.

A lot is the quantity in multiples of which an order must be **contracted** .

A basic function of a market segment is to match buy and ...Figure 7B depicts a refinement of Figure 3B of a market interval of an AC **power** **transfer** product type. The product type 1 1 1 0 of the market interval is further ...Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power** **transfer** product type. The product type 1 1 1 0 of the ...a market to trade transfer capability between users.

Because of the linear nature of AC **power** **transfer** throughout an AC **power**
network, these **transfer** rights can generally be linearly accumulated to insure the **contracted** transfers are physically feasible in satisfying the overall flowgate constraints of the AC power network...
...depicts a refinement of Figures 7B and 7C of a market interval of an AC **power** **transfer** point-to-point product type. The product type 1 1 16 of the market interval...node of the first A C power network. However, a market interval for an AC **power** **transfer** point-topoint product type further possesses all the ancillary flowgate transmission rights required for the...liquidity, participants should be very comfortable posting bids and offers for point-to-point AC **power** **transfer** rights, since they constitute complete products from a participant perspective.

Bids for AC **power** **transfer** point-to-point market intervals are comprised of ...for at least one flowgate transmission right sharing the same location. Bids for A C **power** **transfer** point-to-point market intervals may further comprise bids for each of the flowgates of the flowgate collection sharing the same location. Bids for A C 1 0 **power** **transfer** point-to-point market intervals may further comprise transmission rights for at least one flowgate...a collection of constrained transmission lines, will be denoted by a flowgate designator. An AC **power** **transfer** amount
from node1 to node2 produces an amount of AC **power** **transfer** across the
flowgate as essentially ...collection, there is at least one market interval in the market interval collection of AC **power** **transfer** product type with the flowgate location.

Each validated order of the validated order collection with the AC **power**

transfer product type of the associated market interval may further contain an amount. A validated order of AC **power transfer** product type from the first node to the second node may be further ...Note that there may be a price associated with each validated order of the AC **power transfers** of the flowgates. There may be a price associated with the A C **power transfer** from the first node to the second node.

Figure 9A depicts a market interval of...second node of a second AC power network. The product type collection further comprises DC **power transfer** . For each DC power line of the DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with the location as the location of the DC power line.

51
Figure...current market price in dollars per megawatt-hour 701 0 is 1 2.96". The **contracted** position in net megawatts 7012 is 1 2.00". The
53
pending position in net...

...total position in net megawatts 7016 is "25.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...7102.

The current market price in dollars per megawaff-hour 7110 is "16.72". The **contracted** position in net megawatts 7112 is "10.00". The pending position in net megawatts 7114 **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...has a succession of rows with entries from 1 to 24, indicating the hourly AC **power transfer** markets 0 7204 in the flowgate location "Flowgate-a" 7202. Consider the row labeled b interval with AC **power transfer** product type, flowgate 7202 location and hour time interval ending at 1:00 for May...

...The current market price in dollars per megawatt-hour 721 0 is "0.00". The **contracted** position in net megawatts 5 7212 is "0.00". The pending position in net megawatts...

...total position in net megawatts 7216 is "0.00", which is the sum of the **contract** and pending positions for that market interval. The **contracted** flow 7224 is "0.00".

The pending flow 7226 is "0.00". The total flow...the source generation, transmission rights and destination loading, where applicable, which preferably becomes a single **contract** . This creates a fundamental simplification in the conceptual effort required to trade energy delivery.

Figure...of Figure 26.

Note that at least one of the market intervals contains an AC **power transfer** product type as the fungible, ephemeral commodity and contains the location as 1 0 a...each be further based upon the flowgate collection.

The market interval may contain the AC **power transfer** product type as the fungible, ephemeral commodity and further, the market interval may contain an

AC **power transfer** point-to-point product ...contained in the flowgate collection, at least one of the market intervals contains the AC **power transfer** product type as the fungible, ephemeral commodity and the location coinciding with the flowgate entry...for the new bundles exceeds the aggregate
offers for the old bundles, the optimization system **contracts** orders for the bundles and performs the disassembly and reassembly.

The optimization system performs some...seconds if orders were coming in more often than every few seconds. Since orders are **contracting** continuously, the invention provides a true forward market, with prices locked-in at the time of **contracting** .

Aside from speed, another nice feature of LPs is that they give a shadow price...

...prices would always be available, even when the LIP was run and 1 0 nothing **contracted** . The component prices could be used to calculate ...quote attractive places an order at any time and is assured that the order will **contract** at the quoted price. Participants can therefore negotiate energy deals on any terms they wished...exceed
AZ-CA reused).

This example is simple enough to work by hand. The resulting **contract** will be
y1=50 MW (that is, 50 MW of bundle 1 bought) and y2...placed the order, not the account name). Bids and offers with which the user cannot **contract** (due to counterparty selections, if using Self-Managed credit) appear with the same background color...bid or offer depth on a row changes for any reason (such as an order **contracted** or withdrawn), the bid and offer columns blink briefly to provide a clear visual signal...in bold.

'Virtual" orders are shown in Italics.

a. Orders with which the participant cannot **contract** due to credit selections are 1 0 shown against the same color background as is...new orders, on behalf of participant "Specify Later'.

Orders with which the selected participant cannot **contract** due to counterparty selection should appear with the background color used for titles and borders...

...would on the participant's own screen. The "Specify Later' participant should be able to **contract** with all orders. It is the broker's responsibility to be aware of any restrictions that apply to a participant's ability to **contract** when that participant is to be specified later (this should not be an issue in Scandinavia, where all orders should be able to **contract**).

When the broker enters an order using the Order Entry pop-up window or the...SC as well as the customers of other QSE/SCs using APX systems under ASP **contracts** . This section refers to
these customers as "APX participants". For example, Aquila is an APX...a negative offer, not a bid.

0
The concept here is that, when everything is **contracted** , the absolute bid quantity will become the 'net **contracted** buys by the participant from the counterparty.

Similarly, the absolute offer quantity will become the 'net **contracted** sells by the 5 participant to the counterparty.

"Incremental" ...APX Market and Bilateral transactions are shown, not asset transfers.

In this report, each separately **contracted** portion of an order is considered a separate transaction. If the order was split into several **contracts** by quantity (for example 50 MW with counterparty A and 50 MW with counterparty B into several **contracts** by time (for example, the usees daily 0 on-peak order was matched with 16 hourly orders), then only the **contract** portions spanning the specific interval are listed under that interval.

As usual, the delivery time...give the user a chronological listing of all transactions according to the time the order **contracted** . The report is sorted by transaction time, then by delivery interval. As with the APX Market and Bilateral Transactions by Delivery Interval report, each separately **contracted** portion of an order is considered a separate transaction. Only APX Market and Bilateral transactions...

Claim
... exceeds aggregate
offers of component elements of said sale bundles, then said continuously searching step **contracts** orders for bid bundles ...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

5 The process of Claim 1, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

9 A process for the bundling and trading of energy and...bundle exceeds aggregate
offers of component elements of said sale bundles, then said optimization means **contracts** orders for bid bundles and sale bundles and performs disassembly of sale bundles and reassembles...quote can place an order at any time and be assured that said order is **contracted** at said price quote.
205
. The process of Claim 9, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

17 An apparatus for the bundling and trading of energy and of component elements of said sale bundles, then said continuously
searching module **contracts** orders for bid bundles and sale bundles and performs disassembly of sale bundles and reassembles...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

21 The apparatus of Claim 17, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

25 An apparatus for the bundling and trading of energy and...bundle exceeds aggregate
offers of component elements of said sale bundles, then said optimization means **contracts** orders for bid bundles and sale bundles and performs

...quote can place an order at any time and be assured that said order is **contracted** at said price quote.

29 The apparatus of Claim 25, wherein if said component elements...quote can place an order at any time and be assured that said order is **contracted** at said price quote.
208

8/KWIC/3 (Item 3 from file: 349)
DIALOG(R)File 349:(c) 2003 WIPO/Univentio. All rts. reserv.

Fulltext Availability:
Detailed Description

Detailed Description
... A bus locally connects these local facilities of a node. High voltage AC transmission
lines **transfer** **power** between the cities and the generators in major load
centers of an AC power network...change. The National Electric Reliability Council computes a system of a set of numbers called **power** **transfer** distribution factors available on the North American Reliability Council website, www.nerc.com, showing how...

...different transformers
may have differing transformer capacity limits. These constrained flow lo elements are called **flow** **gates** . In the last few years the importance of **flow**
gates has begun to emerge through the actions of NERC, which has been responsible for building a model estimating **flow** **gate** impact, which can be downloaded from their web site.
A **flow** **gate** of a given AC power network will refer herein to a collection of at
least one line whose total **maximum** safe **carrying** **capacity** will act as a
congested element of the network, constraining AC power delivery between two...

...of that network.

All lines have maximum safe carrying capacities and thus could be considered **flow** **gates** , of a sort. However, historical congestion analysis of specific AC power networks reveals that only a small number of **flow** **gates** account for almost all congestion problems. Such **flow** **gates** will be herein referred to as significant **flow** **gates** .

The associated AC **power** **transfer** across a given **flow** **gate** is additive due to
the super positioning effects previously discussed. Thus in sending 1 00 megawatts along a path, the transmission may have a 1 0% impact on the **flow**
6
gate , putting 10 megawatts on the **flow** **gate** . A second generator may have a
5% impact on that **flow** **gate** . Generating 100 megawatt at the second generator would add 5 megawatt across the **flow** **gate** .

Figure 1 depicts an exemplary AC power network based upon contemporary AC power technology as...

...1 0. Line 11 2 runs between node I 1 0 and node 120.

2o **Flow gate** A 210 is a constraint on the network. Lines 32, 34 and 42 are constrained by **flow gate** A 210 by a total **maximum** safe **carrying capacity** , in that these lines have transmission **capacity** limitations which are easily overloaded when this **maximum** safe **carrying capacity** is exceeded.

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Flow gate B 220 is a constraint on the network. Lines 42 and 44 are constrained by **flow gate** B 220. These lines are also constrained by a total **maximum** safe **carrying capacity** due to system limitations, such as their proximity at some critical junction of the system, such as a mountain pass.

Flow gate C 230 is a constraint on the network. Lines 52 and 62 are constrained by **flow gate** C 230 to a total **maximum** safe□carrying□ **capacity** .

Figure 2 depicts a list of associated AC power functions for each **flow gate** of a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...

...1 1 , the values in the first row of Figure 2 indicate the ratio of **power transferred** across **flow gates** A, B, and C. If the power is generated at Bus 1 1 and consumed...

...commodities or the economic results of transactions involving ephemeral, fungible electrical commodities.

Consider how AC **power transfers** are managed today in most of North Amerca. Transmission rights are considered and negotiated in terms of pointto-point transfers within the network known as **contract** paths. Such thinking is contrary to the previously discussed physics of these AC power networks...

...an essentially linear effect on all transmission lines in the network, and consequently impact all **flow gates** within that network to some extent.

This **contract** path system of scheduling power transmission reserves transmission rights along a particular, direct path through...

...making up the direct path. It often occurs that some constraint, occurring across a significant **flow gate** off that direct path, actually limits the transmission capability on the direct path.

The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** io path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an

AC power network.

Today's **contract** path is based upon a first-come, first-served priority scheme.

What is bought has...

...power transmission from A to B and bought a transmission from B to C. Using **contract** path approach, that does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning power transmission from A ...to purchase separately transmission from A to C. this is because there might be some **flow gate** constraint which would not be met in the two separate paths which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once you have purchased the transmission from A...

...approaches to limiting flow on one path because of the impact on another path. These **contract** path approaches ignore the physics of AC power networks. This leads to situations where even...

...path becomes over-constrained, cuts are issued to compensate. The central operator acts, because a **flow gate** will attempt to exceed its safe carrying capacity, forbidding transmission often across apparently irrelevant paths...

...solution that is based upon the power distribution matrix. This is a matrix of all **power transfer** distribution factors between nodes of the AC power network.

This approach suffers from at least...

...limited amount of detailed information such a system can acquire, or use, to optimize AC **power transfers** . The **power** users are again blind to their options. The players cannot determine what works best for...

...commitment decisions. Nor can price risks be easily hedged.

NERC has developed a methodology addressing **flow gates** to some extent.
2o This is discussed in a document entitled "Discussion Paper on Aligning ...

...shift to a system of reserving and scheduling transmission based on actual use of congested **flow gates** , which they called the 13
FLOWBAT method. Their proposal suffers from a serious omission, it does not address the issue of allocating **flow gate** capacity when demand exceeds supply. By their silence on this issue, it appears that they...

...case called Transaction Participation Functions (TPFs).

These distribution functions refer to transmission paths rather than **flow gates** .

GAPP attempts to align compensation paid by transmission users with actual power flows. However, GAPP is strictly an after-the-fact

settlement system. It alters the current **contract** path scheme only to redistribute the revenue. It does not attempt to allocate scarce transmission...the physics of AC power networks. Further, since transmission rights are predominantly constrained by significant **flow gates** , what is needed should account for the effect on the significant **flow gates** for each **contracted** transmission. A method and mechanism is needed for trading generation and transmission rights in a...the prior art; Figure 2 depicts a list of associated AC power functions for each **flow gate** of a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...

...Figure 6B depicts a refinement of Figure 3B of a market interval of an AC **power transfer** product type; Figure 7 depicts a validated order 1200 comprised of at least two validated...

...has passed; Figure 10A depicts a detail flowchart of operation 2000 of Figure 4 performing **contracting** to create an agreed **contract** from said validate d order collection; Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from said validated order collection; Figure 11A depicts a detail flowchart of operation 2022 of...operation 2092 of Figure 1 OA performing notified biding and asking clients of the agreed **contract** for their respective validated orders; Figure 17A depicts a detail flowchart of operation 2004 of...

...18C depicts a detail flowchart of operation 2120 of Figure IOB performing creating the agreed **contract** at the agreed price and the agreed option price for the agreed amount whenever the...

...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain io embodiments of the invention; Figure 25 depicts a flowchart...collection may be a member of a product type collection comprised of energy and AC **power transfer** . The location of a market interval of an energy product type may be a first...

...contained in the electrical power grid. The location of a market interval of an AC **power transfer** product type may be from a first node of a first AC power network contained...are not limited to acoustic interfaces to humans, audio and visual identification portals to the **contracting** of AC **power transfer** regarding **flow gates** , encoding and decoding mechanisms used in long distance communication and interfaces to recording lo devices of agreed **contracts** .

A program step as used herein refers to instructions in a form executable or inferentially...

...6B depicts a refinement of Figure 3B of a market interval of an AC lo **power transfer** product type. The product type 1 1 1 0 of the market interval is
furtherdescribedasanEnergyproducttypelll0...

...Figure 6C depicts a refinement of Figure 6B of a market interval of an AC **power transfer** product type. The product type 1 1 1 0 of the market interval is
describedasanEnergyproducttypelll0. Thelocation1112isaflowgate of the **flow gate** collection of a first AC power network contained in the
2o electrical power grid. Note that **flow gates** can represent a congestion
constraint across more than one transmission line, and may not have a specific first node to second node description.

Such embodiments of the invention of a **flow gate** market interval are advantageous in providing a market to trade transfer capability between 39
users. Because of the linear nature of AC **power transfer** throughout an AC **power** network, these **transfer** rights can be linearly accumulated to insure the **contracted** transfers are physically feasible in satisfying the overall flowgate constraints of the AC power network... networks indicates each AC power network contained in the electrical power grid further contains a **flow gate** collection of **flow gates** . Each **flow gate** location being either from
an associated first node of the AC power network to an...

...in the case of a collection of constrained transmission lines, will be denoted by a **flow gate** designator. An AC **power**
transfer amount from nodel to node2 produces an amount of AC **power transfer** across the **flow gate** as essentially an associated linear, skewsymmetric function of the amount from nodel to.node2, for each of the **flow gates** of the **flow gate** collection. For each of the□flow□ **gates** of the **flow gate** collection, there is at least one market interval in the market interval collection of AC **power transfer** product type with the **flow gate** location.

Each validated order of the validated order collection with the AC **power**

transfer product type of the associated market interval may further contain an
41
amount. A validated order of AC **power transfer** product type from the first node to the second node may be further comprised of a validated order of the **flow gate** associated market interval. The amount ordered for that **flow gate** is essentially the associated linear, skew-symmetric function of the amount from the first node to the second node, for each of the **flow gates** of the **flow gate** collection.

Note that there may be a price associated with each validated order of the AC **power transfers** of the **flow gates** . There may be a price associated with the AC **power transfer** from the first node to the second node.
I
io Figure 8A depicts a market...

...second node of a second AC power network. The product type collection further comprises DC **power transfer** . For each DC power line of the DC

power line collection, there is at least one associated market interval with DC **power transfer** product type, with the location as the location of the DC power line.

Figure 8B...commodities.

Figure I OA depicts a detail flowchart of operation 2000 of Figure 4 performing **contracting** to create an agreed **contract** from the validated order collection.

Arrow 2090 directs the flow of execution from starting operation 2000 to io operation 2092. Operation 2092 performs **contracting** to create an agreed **contract** from the validated order collection. Arrow 2094 directs execution
from operation 2092 to operation 2096...

...fungible commodities.
Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from the validated order collection.

2o Arrow 2110 directs the flow of execution from starting...

...2118
directs execution from operation 2116 to operation 2120. Operation 2120 performs creating the agreed **contract** for the market interval at the agreed price for the agreed amount whenever the first...

...io Not all validated orders may have a price associated with them. Consider an
AC **power transfer** from nodel to node2 of an AC power network. Assume that AC power network has a collection of three **flow gates** . A validated order for an AC **power transfer** amount from nodel to node2 may contain validated orders for an associated amount for each **flow gate** of the **flow gate** collection.

Each of the **flow gate** validated orders may contain prices for their respective
flow gate . The agreed amount would be calculated based upon the associated amounts and pricing of the **flow gates** . Alternatively, all validated orders may have a price associated with them.

These operations may be...collection may be a member of a product type collection comprised of energy and AC **power transfer** . Thellocation of a market interval having an energy product type may be a first node...

...contained in the electrical power grid. The location of a market interval having an AC **power transfer** product type may be from a first lo node of a first AC power network...by the first party, to act on behalf of the first party with respect to **contracting** .

Server system 3500 includes at least one server computer 3520 coupled to network 3200. Network...

...various personal optimizations and
shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

Server system 3500 may include at least one server...

...operation 2092 of Figure 1 OA
performing notified biding and asking clients of the agreed **contract** for their respective validated orders.

52
Arrow 2270 directs the flow of execution from starting...

...2278
directs execution from operation 2276 to operation 2280. Operation 2280 performs sending a bid **contract** message based upon the agreed **contract** to the bid client. Arrow 2282 directs execution from operation 2280 to operation
2284. Operation 2284 performs sending an ask **contract** message based upon
lo the agreed **contract** to the ask client. Arrow 2286 directs execution from operation 2284 to operation 2288. Operation...

...the capacity option price, besides just price of
purchase. In agreeing to a capacity option **contract** , the seller is only guaranteed the earnings of the capacity option price, and the buyer...

...to buy the optioned capacity, it is
at the price already agreed upon in the **contract** . The seller then makes additional income from the actual purchased amount at the agreed price...
18C depicts a detail flowchart of operation 2120 of Figure 10B performing creating the agreed **contract** at the agreed price and the a'reed
9
option price for the agreed amount...

...of execution from starting operation 2120 to operation 2372. Operation 2372 performs creating the agreed **contract** for the market interval at the agreed price and the agreed option price for the...by the first party, to act on behalf of the first party with respect to **contracting** .

As shown in Figure 15, server system 3500 includes at least one server computer 3520...

...various
personal optimizations and shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

Server system 3500 may include at least one server...
...various
personal optimizations and shortcuts, including, but not limited to, macro style functions and standard **contract** forms employed by the client 3190.

io As shown in Figure 15, server system 3500...1998. The current market price in dollars per megawatt
hour 4010 is "12.96". The **contracted** position in net megawatts 4012 is io "12.00". The pending position in net megawatts...

...total position in net megawatts 4016 is "25.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net
megawatts-hours...

...market price in dollars per megawaft-hour 41 1 0 is "1 6.72". The

contracted position in net megawatts 4112 is "10.00". The pending position in net megawatts 4114...

...position in net megawatts 4116 is "l 0.00", which is the sum of the **contract** and pending positions for that market io interval. The highest... bid quantity in net megawafts...
...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain embodiments of the invention.

The displayed information 4200 includes a variety of fields, including field 4202, where a specific **flow gate** or intertie may be selected. Immediately 2o below that field is a field which specifies...

...a succession of lo rows with entries from 1 to 24, indicating the hourly AC **power transfer** markets 4204 in the **flow gate** location "COCOPP Unit 1" 4202. Consider the row labeled by the hour 4208 ending at "3". This row displays the market state of the market interval with AC **power transfer** product type, **flow gate** 4202 location and hour time interval ending at 1:00 for May 10, 1999. The current market price in dollars per megawatt-hour 421 0 is "O.00". The **contracted** position in net megawatts 4212 is "O.00". The pending position in net megawatts 4214...

...total position in net megawatts 4216 is "O.00", which is the sum of the **contract** and pending positions for that market interval. The **contracted** flow 4224 is "O.00". The pending flow 4226 is "O.00".

2o The total...

8/KWIC/4 (Item 4 from file: 349)

Fulltext Availability:
Detailed Description

Detailed Description
... A bus locally connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network...that different transformers may have differing transformer capacity limits.

These constrained flow elements are called **flow gates** . In the last few years the importance of **flow gates** has begun to emerge through the actions of NERC, which has been responsible for building a model estimating **flow gate** impact, which can be downloaded from their web site.

io A **flow gate** of a given AC power network will refer herein to a collection of at least one line whose total **maximum** safe **carrying capacity** will act as a congested element of the network, constraining AC power delivery between two...

...of that network.

All lines have maximum safe carrying capacities and thus could be considered **flow gates**, of a sort. However, historical congestion analysis of specific AC power networks reveals that only a small number of **flow gates** account for almost all congestion problems. Such **flow gates** will be herein referred to as significant **flow gates**.

The associated AC **power transfer** across a given **flow gate** is additive due to the super positioning effects previously discussed. Thus in sending 100 megawatts along a path, the transmission may have a 10% impact on the **flow gate**, putting 10 megawatts on the **flow gate**. A second generator may have a 5% impact on that **flow gate**. Generating 100 megawatt at the second generator would add 5 across the **flow gate**.

Figure 1 depicts an exemplary AC power network based upon contemporary AC power technology as...between node 100 and node 110. Line 112 runs between node 110 and node 120.

Flow gate A 210 is a constraint on the network. Lines 32, 34 and 42 are constrained by **flow gate** A 210 by a total **maximum** safe□carrying□ **capacity**, in that these lines have transmission **capacity** limitations which are easily overloaded when this **maximum** safe **carrying capacity** is exceeded.

Flow gate B 220 is a constraint on the network. Lines 42 and 44 are constrained by **flow gate** B 220. These lines are also constrained by a total **maximum** safe' **carrying capacity** due to system limitations, such as their proximity at some critical junction of the system, such as a mountain pass.

Flow gate C 230 is a constraint on the network. Lines 52 and 62 are constrained by **flow gate** C 230 to a total **maximum** safe□carrying□ **capacity**.

Figure 2 depicts a list of associated AC power functions for each **flow gate** of a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...

...commodities or the economic results of transactions involving ephemeral, fungible electrical commodities.

Consider how AC **power transfers** are managed today. Transmission rights are considered and negotiated in terms of point-to-point transfers within the 2o network known as **contract** paths. Such thinking is contrary to the previously discussed physics of these AC power networks...

...an essentially linear effect on all transmission lines in the network, and consequently impact all **flow gates** within that network to some extent.

This **contract** path system of scheduling power transmission reserves transmission rights along a particular, direct path through...making up the direct path. It often occurs that some constraint, occurring across a significant **flow gate** off that direct path, actually limits the transmission capability on the direct path.

9
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The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.

Today's **contract** path is based upon a first-come, first-served priority scheme.

io What is bought...
...power transmission from A to B and bought a transmission from B to C. Using **contract** path approach, that does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning
power transmission from A to B and from B to...

...to
purchase separately transmission from A to C. This is because there might be some **flow gate** constraint which would not be met in the two separate paths
which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once the transmission from A to B is...

...the constraint, when a particular path becomes over-constrained, cuts are issued across apparently irrelevant **contracted**
paths to compensate. The central operator acts, because a **flow gate** will
overflow, forbidding transmission often across apparently irrelevant paths to compensate.

10
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...limited amount of detailed
information such a system can acquire, or use, to optimize AC **power transfers** . The **power** users are again blind to their options. The players
cannot determine what works best for...

...that could contribute to market efficiency and price stability.

NERC has developed a methodology addressing **flow gates** to some extent.

This is discussed in a document entitled "Discussion Paper on Aligning Transmission...

...shift to a system of reserving and scheduling transmission based on actual use of congested **flow gates** , which they called the FLOWBAT method. Their proposal suffers from a serious omission, it does not address the issue of allocating **flow gate** capacity when demand exceeds supply. By their silence on this issue, it appears that they... case called Transaction Participation Functions (TPFs). These distribution functions refer to transmission paths rather than **flow gates** .

GAPP attempts to align compensation paid by transmission users with actual power flows. However, GAPP is strictly an after-the-fact settlement system. It alters the current **contract** path scheme only to redistribute the revenue. It does not attempt to allocate scarce transmission...

...the physics of AC power networks. Further, since transmission rights are predominantly constrained by significant **flow gates** , what is needed should account for the effect on the significant **flow gates** for each **contracted** transmission. A method and mechanism is needed for planning the operations of devices and further support virtual trading in the ephemeral, fungible commodity and the incorporation of agreed **contracts** into the knowledge interval collection used to create the device operating schedule.

Certain further embodiments...
...further advantageously support virtual trading in the ephemeral, fungible commodity and the incorporation of agreed **contracts** into the knowledge interval collection used to create the device operating schedule. Note that the...the prior art; Figure 2 depicts a list of associated AC power functions for each **flow gate** of io a collection of **flow gates** for each of the busses of the various nodes of the exemplary AC power network...interval collection is a member of a product type collection comprised of energy and AC **power transfer** . In certain io further embodiments, the location of a market interval having an energy product...

...power grid. In certain further embodiments, the location of a market interval having an AC **power transfer** product type is from a first node of a first AC power network contained in...are not limited to acoustic interfaces to humans, audio and visual identification portals to the **contracting** of AC **power transfer** regarding **flow gates** , encoding and decoding mechanisms used in long distance communication and interfaces to recording devices of agreed **contracts** . A program step as used herein refers to instructions in a form that either by...

8/KWIC/5 (Item 5 from file: 349)

Fulltext Availability:

Claims

Claim
... wherein said program operating system contains a program code segment supporting contracting an AC power **transfer** on said AC power 2o network further comprising;
a program code segment supporting **contracting** an associated AC **power transfer** on each of said **flow gates** of said□flow gate□ collection.

53 A computing system of Claim 52,
wherein said program code segment supporting **contracting** for said AC **power transfer** on said AC power network further comprises;
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on
each of said **flow gates** of said **flow gate** collection; and
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights.

54 A computing system of Claim 53,
wherein each of said **flow gates** of said **flow gate** collection has an
associated **maximum** safe **carrying capacity** ; and
said program operating system further containing a program code segment supporting scheduling said AC **power transfer** for said agreed **contract**
comprising;
a program code segment supporting determining whether said associated AC **power transfer** of said **flow gate** of said□flow gate□ collection satisfies said associated **maximum** safe **carrying capacity** of said **flow gate** for each of said **flow**
gates of said **flow gate** collection; and
a program code segment supporting approving said AC **power transfer** whenever said associated AC **power transfer** of said **flow gate** satisfies said **maximum** safe **carrying capacity** for each said□flow□ **gates** of said **flow gate** collection.

55 A computing system of Claim 54, further comprised of:
a client computer collection...
...of said server computers of said server system; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises
a program code segment residing in said computer...

...received stimulus stream and said received server stream; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises;
57P
a program code segment supporting communicating via...delivery stream.

57 A computing system of Claim 56,
wherein said program code segment supporting **contracting** AC **power transfer** on said AC power network further comprises;
a program code segment supporting operating a virtual trading floor containing a market interval for trading AC **power transfer** for each of said **flow**

gates of said **flow** **gate** collection further comprising
a program code segment supporting transforming said received server
i o delivery...
...one bid order and at
least one ask order; and
a program code segment supporting **contracting** AC **power** **transfer** on
said AC power network to create an agreed **contract** based upon a first
of said bid orders of said order collection and based upon...

...collection comprising a bid type and an ask type;
wherein said program code segment supporting **contracting** said A C
power **transfer** on said AC power network to create an agreed **contract**
further
comprises;
a program code segment supporting **contracting** said AC **power** **transfer**

on said AC power network to create an agreed **contract** based upon a
first bid type order of said validated orders of said validated order...

...order collection.

59 A computing system of Claim 58,
wherein said program code segment supporting **contracting** for said A C
power **transfer** on said AC power network to create an agreed **contract**
by a first
party to own AC **power** **transfer** trading rights with associated AC
power
transfers on each of said **flow** **gates** of said□flow gate□
collection further comprises;
a program code segment supporting **contracting** for said AC **power**
transfer on said AC power network to create an agreed **contract** by a
first party to own AC **power** **transfer** trading rights with associated.
AC **power** **transfers** on each of said **flow** **gates** of said□flow□
gate collection based upon a first bid type order of said validated
orders of said validated...

...computing system of Claim 59. wherein at least one market interval is
associated with each **flow** **gate** of said **flow** **gate** collection.

61 A computing system of Claim 60,
wherein said server system is further comprised...

...amended, new claims 62-64 added, remaining claims
unchanged (1 3 pages)]
A method for **contracting** AC powe'r transfer on an AC power network with
a **flow** **gate** collection containing at least one **flow** **gate**
comprising:
contracting an AC **power** **transfer** on said AC power network to take
place
over a first time interval comprising:
contracting an associated AC **power** **transfer** on each of said□flow□
gates of said **flow** **gate** collection to take place over at least said
first time interval; and
contracting an AC **power** **transfer** collection of at least two AC
power
lo **transfers** on an AC power network further comprises:
contracting a sum of said associated AC **power** **transfer** for each of
said
AC **power** **transfers** of said AC **power** **transfer** collection on each
of said **flow** **gates** of said **flow** **gate** collection.

2 The method of Claim 62,
wherein **contracting** for AC **power** **transfer** on said AC power network comprises:
contracting for AC **power** **transfer** on said AC power network to take place
over a first time interval; and
wherein **contracting** said associated AC **power** **transfer** on each of said
flow **gates** of said **flow** **gate** collection comprises
contracting said associated AC **power** **transfer** on each of said□flow□ **gates**
of said **flow** **gate** collection to take place over at least said first time interval.

3 The method of Claim 2, further comprising:
co, rtrac ng an AC **power** **transfer** collection of at least two AC **power**
transfers on an AC power network further comprises
contracting a sum of said associated AC **power** **transfer** for each of said
AC **power** **transfers** of said AC **power** **transfer** collection on each
of said **flow** **gates** of said **flow** **gate** collection.

4 The method of Claim 1 9
wherein each **flow** **gate** of said **flow** **gate** collection has an associated
maximum safe **carrying** **capacity** ; and
wherein **contracting** said sum of said associated AC **power** **transfer** for
each of said AC **power** **transfers** of said AC **power** **transfer** collection on each of
said **flow** **gates** of said **flow** **gate** collection comprises
59
AMUENDED SHEET (ARTICLE 19)
said sum of said associated AC **power** **transfer** for each of said AC **power**
transfers of said AC **power** **transfer** collection satisfying said
associated **maximum** safe **carrying** **capacity** on each of said□flow□ **gates** of said **flow** **gate** collection.

5 The method of Claim 1,
wherein each of said AC **power** **transfers** of said AC **power** **transfer** collection is to take place over a first time interval; and
wherein **contracting** said sum of said associated AC **power** **transfer** for
each of said AC **power** **transfers** of said AC **power** **transfer** collection on ea ch of
said **flow** **gates** of said **flow** **gate** collection comprises
contracting each of said sum of said associated AC **power** **transfer** for each of said AC **power** **transfers** of said AC **power** **transfer** collection to take place Cat ...said first time interval.
6 The method of Claim 1,
wherein each of said AC **power** **transfers** of said AC **power** **transfer**
1 5 collection has an associated amount of energy from an associated first node of
said AC power network to a second node of said AC power network; and
wherein **contracting** said sum of said associated AC **power** **transfer** for
each of said AC **power** **transfers** of said AC **power** **transfer**

collection on each of
said **flow gates** of said **flow gate** collection comprises
contracting an amount of energy of said associated AC **power transfer**
on
each of said **flow gates** of said **flow gate** collection as
essentially an associated linear, skew-symmetric function of said
associated amount of energy...

...first node to said associated second node.

9 The method of Claim 1 9
wherein **contracting** for said AC **power transfer** on said AC power
network
comprises
contracting for said AC **power transfer** on said AC power network to
create an agreed **contract** by a first party to own AC **power transfer**
trading rights with associated AC **power transfers** on each of said
flow gates of said **flow gate**
collection; and
enabling said first party to further **contract** to sell said first party
owned A C **power transfer** trading rights.

11 The method of Claim 1 0,
wherein enabling said first party to further **contract** to sell said
first party
owned AC **power transfer** trading rights comprises
60
AMENDED SHEET (ARTICLE 19)
enabling said first party to further **contract** to sell said first party
owned A C **power transfer** trading rights before scheduling said AC
power transfer for said agreed **contract** .

13 The method of Claim 12,
wherein determining whether said associated AC **power transfer** of said
flow gate of said **flow gate** collection satisfies said associated
maximum safe **carrying capacity** of said□flow gate□for each of
said **flow gates** of said **flow gate**
collection further comprises
determining whether said associated AC **power transfer** of said **flow**
gate
i o of said **flow gate** collection satisfies said associated **maximum**
safe **carrying capacity** of said **flow gate** for each of said□flow□
gates of said **flow gate** collection
over said first time interval; and
wherein approving said AC **power transfer** whenever said associated A C
power transfer of said **flow gate** satisfies said□maximum□safe
carrying capacity for
i5 each said **flow gate** of said **flow gate** collection further
comprises
approving said AC **power transfer** over said first time interval
whenever
said associated AC **power transfer** of said **flow gate** satisfies
said **maximum** safe **carrying capacity** for each said□flow gates□of
said **flow gate** collection over said first time interval.

14 The method of Claim 13, further comprising:
contracting for an AC **power transfer** collection of at least one AC
power
transfer to create an agreed **contract** by a first party to own AC
power transfer trading rights with associated AC **power transfers**

on each of said **flow** **gates** of
said **flow** **gate** collection further compdses
contracting for a sum of associated AC **power** **transfers** for all AC **power**
transfers of said AC **power** **transfer** collection to create a **contract** for an associated AC **power** **transfer** for said collection of AC **power** **transfers** for each of said **flow** **gates** of said□flow□ **gate** collection.

15 The method of Claim 14,
wherein each of said AC **power** **transfers** of said AC **power** **transfer** collection has an associated amount of energy from an associated first node of
said AC power network to said second node of said AC power network;
wherein **contracting** for a sum of associated AC. **power** **transfers** for all A C **power** **transfers** of said AC **power** **transfer** collection to create a **contract** for an associated AC **power** **transfer** for said collection of AC **power** **transfers** for each
of said **flow** **gates** of said **flow** **gate** collection comprises
61
AMENDED SHEET (ARTICLE 19)
calculating said associated AC **power** **transfer** on said **flow** **gate** of said
AC **power** **transfer** as an amount of energy which is an essentially linear, skew
symmetric associated function of said amount of energy of said AC **power** **transfer** from said associated first node of said AC **power** **transfer** to said associated second node of said AC **power** **transfer** of each of said **flow** **gates** of said **flow** **gate** collection.

16 The method of Claim 9,
wherein enabling said first party to further **contract** to sell said first party
owned AC **power** **transfer** trading rights further comprises
I 0 enabling said first party to further **contract** to sell said first party owned A C **power** **transfer** trading rights for said associated AC **power** **transfer** for a first of said **flow** **gates** of said□flow gate□ collection.

17 The method of Claim 16,
wherein enabling said first party to further **contract** to sell said first party
1 5 owned AC **power** **transfer** trading rights further comprises
enabling said first party to further **contract** to sell said first party owned A C **power** **transfer** trading rights for said associated AC **power** **transfer** for each of said **flow** **gates** of said□flow gate□ collection.

23 The method of Claim 22, further comprising:
a first client user operating said...

...interactive status based upon said received stimulus stream and said received server stream; and
wherein **contracting** said AC **power** **transfer** on said AC power network further comprises
communicating via said network with said first client computer to create a received server delivery stream.

24 The method of Claim 23,
wherein **contracting** AC **power** **transfer** on said AC power network

further
comprises
62
AMENDED SHEET (ARTICLE 19)
operating a virtual trading floor containing a market for trading AC **power transfer** for each of said **flow gates** of said□flow gate□ collection further comprising transforming said received server delivery stream into an order collection
containing at least one bid order and at least one ask order, and
contracting AC **power transfer** on said AC power network to create an agreed **contract** based upon a first of said bid orders of said order collection and based upon...

...with
program code segments contmcting AC power tmnsfer on an AC power network with a **flow gate** collection containing at least one **flow gate** , comprising:
a program code segment supporting **contracting** an AC **power transfer** on
said AC power network to take place over a first time interval comprising:
1 5 a program code segment supporting **contracting** an associated AC **power**
transfer on each of said **flow gates** of said□flow gate□ collection to take place over
at least said first time interval; and
a program code segment supporting **contracting** an AC **power transfer** collection of at least two AC **power transfers** on an AC power network to take
place over said first time interval further comprises:
a program code segment supporting **contracting** a sum of said associated AC **power transfers** for each of said AC **power transfers** of said AC **power**
transfer collection on each of said **flow gates** of said□flow gate□ collection to take place at least over at least said first time.

26 The program operating system of Claim 63,
wherein said program code segment supporting **contracting** an AC **power transfer** on said AC power network comprises
a program code segment supporting **contracting** an AC **power transfer** on
said AC power network to take place over a first time interval; and
wherein said program code segment supporting **contracting** said associated AC **power transfer** on each of said **flow gates** of said **flow gate** collection comprises
a program code segment supporting **contracting** said associated A C **power transfer** on each of said **flow gates** of said□flow gate□ collection to take place over at least said first time interval.

28 The program operating system of Claim 25,
63
AM[ENDED SHEET (ARTICLE 19)
wherein each **flow gate** of said **flow gate** collection has an associated
maximum safe **carrying capacity** ; and
wherein said program code segment supporting **contracting** said sum of said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection on each of said□flow□ **gates** of said **flow gate**

collection comprises
a program code segment supporting said sum of said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection satisfying said associated **maximum** safe **carrying capacity** on each of io said **flow gates** of said□flow□ **gate** collection.

29 The program operating system of Claim 27,
wherein each of said AC **power transfers** of said AC **power transfer** collection is to take place over a first time interval; and
wherein said program code segment supporting **contracting** said sum of 1 5 said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection on each of said□flow□ **gates** of said **flow gate**
collection comprises
a program code segment supporting **contracting** said sum of said associated AC **power transfer** for each of said AC **power transfers** of said AC **power transfer** collection to take place at least over at least said first time interval on each of said **flow gates** of said **flow gate** collection.

30 The program operating system of Claim 25,
wherein each of said AC **power transfers** of said AC **power transfer** collection has an associated amount of energy from an associated first node of
said AC...

...to a second node of said AC power network; and
said program code segment supporting **contracting** said sum of said associated AC **power transfer** for each of said AC **power transfers** of said A C **power transfer** collection on each of said **flow gates** of said **flow gate** collection
comprises
a program code segment essentially calculating an amount of energy of said associated AC **power transfer** on each of said **flow gates** of said **flow gate** collection as essentially an associated linear, skew-symmetric function of said associated amount of energy...

...node.

33 The program operating system of Claim 25,
wherein said program code segment supporting **contracting** for said A C **power transfer** on said AC power network further comprises
64
AMENDED SHEET (ARTICLE 19)
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on
each of said **flow gates** of said **flow gate** collection; and
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights.
34 The program operating system of Claim 33,
wherein each of said **flow gates** of said **flow gate** collection has an
associated **maximum** safe **carrying capacity** ; and
further comprising a program code segment supporting scheduling said AC **power transfer** for said agreed **contract** comprising
a program code segment supporting determining whether said associated

AC **power** **transfer** of said **flow** **gate** of said□flow gate□
collection satisfies said associated **maximum** safe **carrying** **capacity**
of said **flow** **gate** for each of said **flow**
i 5 **gates** of said **flow** **gate** collection; and
a program code segment supporting approving said AC **power** **transfer**
whenever said associated AC **power** **transfer** of said **flow** **gate**
satisfies said **maximum** safe **carrying** **capacity** for each said□flow□
gates of said **flow** **gate** collection.
2o 37. The program operating system of Claim 36,
wherein determining whether said associated AC **power** **transfer** of said
flow **gate** of said **flow** **gate** collection satisfies said associated
maximum safe **carrying** **capacity** of said□flow gate□for each of
said **flow** **gates** of said **flow** **gate**
collection further comprises
determining whether said associated AC **power** **transfer** of said **flow**
gate
of said **flow** **gate** collection satisfies said associated **maximum** safe
carrying **capacity** of said **flow** **gate** for each of said□flow□
gates of said **flow** **gate** collection
over said first time interval; and
wherein approving said AC **power** **transfer** whenever said associated A C
power **transfer** of said **flow** **gate** satisfies said□maximum□safe
carrying **capacity** for
each of said **flow** **gates** of said **flow** **gate** collection further
comprises
approving said AC **power** **transfer** over said first time interval
whenever
said associated AC **power** **transfer** of said **flow** **gate** satisfies
said **maximum** safe **carrying** **capacity** for each said□flow gates□of
said **flow** **gate** collection over said first time interval.

38 The program operating system of Claim 37, further comprising:
65
AM[ENDED SHEET (ARTICLE 19)
a program code segment supporting **contracting** for an AC **power**
transfer
collection of at least one AC **power** **transfer** to create an agreed
contract by a first
party to own AC **power** **transfer** trading rights with associated AC
power
transfers on each of said **flow** **gates** of said□flow gate□
collection further comprises
a program code segment supporting **contracting** for a sum of associated
AC **power** **transfers** for all AC **power** **transfers** of said AC□power□
transfer
collection to create a **contract** for an associated AC **power** **transfer**
for said collection of AC **power** **transfers** for each of said **flow**
gates of said **flow** **gate** collection.
I o 39. The program operating system of Claim 38,
wherein each of said AC **power** **transfers** of said AC **power** **transfer**
collection has an associated amount of energy from an associated first
node of
said AC...

...to said second node of said AC power network;
wherein a program code segment supporting **contracting** for a sum of
associated AC **power** **transfers** for all AC **power** **transfers** of said
AC **power** **transfer** collection to create a **contract** for an associated
AC **power** **transfer** for said collection of AC **power** **transfers** for
each of said **flow** **gates** of said **flow** **gate**

collection comprises
a program code segment calculating each of said associated AC **power transfers** on said **flow gate** of said AC□power transfer□has an amount of energy as an essentially linear, skew-symmetric function of said amount of energy from said associated first node to said associated second node of said AC **power transfer** of each of said **flow gates** of said **flow gate** collection.

40 The program operating system of Claim 33,
wherein said program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading fights
further comprises
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights for said 3o associated AC **power transfer** for a first of said **flow gates** of said **flow gate** collection.

41 The program operating system of Claim 40,
wherein said program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights
further comprises
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights for said
66
AMENDED SHEET (ARTICLE 19)
associated AC **power transfer** for each of said **flow gates** of said **flow gate** collection.

45 The program operating system of Claim 25,
wherein said computing system is further...

...of said server computers of said server
system; and
wherein said program code segment supporting **contracting** said AC **power transfer** on said AC power network further comprises
a program code segment residing in said computer...

...received stimulus stream and said received server stream; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises
a program code segment supporting communicating via said...

...stream.

47 The program operating system of Claim 46,
wherein said program code segment supporting **contracting** AC **power transfer** on said AC power network further comprises
67
AMENDED SHEET (ARTICLE 19)
a program code segment supporting operating a virtual trading floor containing a market interval for trading AC **power transfer** for each of said **flow**
gates of said **flow gate** collection further comprising
a program code segment supporting transforming said received server delivery stream into...

...one bid order and at

least one ask order, and
a program code segment supporting **contracting** AC power tmnsfer on said AC power network to create an agreed **contract** based upon a first of said bid orders of said order collection and based upon...
...collection.

49 The program operating system of Claim 48,
wherein supporting contmcting for said AC **power transfer** on said A C power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on each of said **flow**
1 5 **gates** of said **flow gate** collection further comprises
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on each of said□flow□ **gate** collection based upon a first bid type order of said validated orders of said validated...

...A computing system supporting program operating system of program code segments with program code segments **contracting** an AC **power transfer** on an AC power network with a **flow gate** collection containing at least one **flow**
gate , comprised of:
at least one computer, each of said computers in said computing system coupled...
...in said computing
system;
wherein said program operating system contains a program code segment supporting **contracting** an AC **power transfer** on said AC power
network further to take place over a first time interval comprising:
a program code segment supporting **contracting** an associated AC **power transfer** on each of said **flow gates** of said□flow gate□ collection to take place over
at least said first time interval; and
68
AMENDED SHEET (ARTICLE 19)
a program code segment supporting **contracting** an AC **power transfer** collection of at least two AC **power transfers** on an AC power network to take
place over said first time interval further comprises:
a program code segment supporting **contracting** a sum of said associated AC **power transfers** for each of said AC **power transfers** of said AC **power**
transfer collection on each of said **flow gates** of said□flow gate□ collection to take place at least over at least said first time.
53 A computing system of Claim 52,
wherein said program code segment supporting **contracting** for said AC i o **power transfer** on said AC power network further comprises
a program code segment supporting **contracting** for said AC **power transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power transfer** trading rights with associated AC **power transfers** on
each of said **flow gates** of said **flow gate** collection; and
a program code segment supporting enabling said first party to further **contract** to sell said first party owned AC **power transfer** trading rights.

54 A computing system of Claim 53,

wherein each of said **flow gates** of said **flow gate** collection has an
associated **maximum** safe **carrying capacity** ; and
said program operating system further containing a program code segment supporting scheduling said AC **power transfer** for said agreed contrad
comprising
a program code segment supporting determining whether said associated AC **power transfer** of said **flow gate** of said□flow gate□ collection satisfies said associated **maximum** safe **carrying capacity** of said **flow gate** for each of said **flow**
gates of said **flow gate** collection; and
a program code segment supporting approving said AC **power transfer** whenever said associated AC **power transfer** of said **flow gate** satisfies said **maximum** safe **carrying capacity** for each said□flow□ **gates** of said **flow gate** collection.

56 A computing system of Claim 55,
wherein said program operating system further comprising...

...received stimulus stream and said received server stream; and
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network further comprises
a program code segment supporting communicating via said...

...i o 57. A computing system of Claim 56,
wherein said program code segment supporting **contracting** AC **power transfer** on said AC power network further comprises
a program code segment supporting operating a virtual trading floor containing a market interval for trading AC **power transfer** for each of said **flow**
i 5 **gates** of said **flow gate** collection further comprising
a program code segment supporting transforming said received server delivery stream into...

...one bid order and at
least one ask order, and
a program code segment supporting **contracting** AC **power transfer** on said AC power network to create an agreed **contract** based upon a first of said bid orders of said order collection and based upon...

...collection comprising a bid type and an ask type;
wherein said program code segment supporting **contracting** said A C **power transfer** on said AC power network to create an agreed **contract** further
comprises
a program code segment supporting **contracting** said AC **power transfer**

on said AC power network to create an agreed **contract** based upon a first bid type order of said validated orders of ...order collection.

59 A computing system of Claim 58,
wherein said program code segment supporting **contracting** for said A C **power transfer** on said AC power network to create an agreed **contract** by a first
party to own AC **power transfer** trading rights with associated AC **power**
transfers on each of said **flow gates** of said□flow gate□ collection further comprises
70

AM[ENDED SHEET (ARTICLE 19)
a program code segment supporting **contracting** for said AC **power** **transfer** on said AC power network to create an agreed **contract** by a first party to own AC **power** **transfer** trading rights with associated AC **power** **transfers** on each of said flow g ates of said **flow** **gate** -collection based upon a first bid type order of said validated orders of said validated...

...type order of said validated orders of said validated order collection.

62 A method for **contracting** AC **power** **transfer** on an AC power network with
a **flow** **gate** collection containing at least one **flow** **gate** comprising:
contracting an AC **power** **transfer** on said AC power network comprising
I 0 **contracting** an associated AC **power** **transfer** on each of said **flow** **gates** of said **flow** **gate** collection.

63 A program operating system executing on a computing system comprised of at least...

...said computing system coupled to an associated computer readable memory, supporting with
program code segments **contracting** AC **power** **transfer** on an AC power network with a **flow** **gate** collection containing at least one **flow** **gate** , comprising:
a program code segment supporting **contracting** an AC **power** **transfer** on
said AC power network comprising
a program code segment supporting **contracting** an associated AC **power** **transfer** on each of said **flow** **gates** of said□flow gate□ collection.

64 A computing system supporting program operating system of program code segments with program code segments **contracting** an AC **power** **transfer** on an AC power network with a **flow** **gate** collection containing at least one **flow** **gate** , comprised of:
at least one computer, each of said computers in said computing system coupled...

...in said computing
system;
wherein said program operating system contains a program code segment supporting **contracting** an AC **power** **transfer** on said AC power
network further comprising
a program code segment supporting **contracting** an associated AC **power** **transfer** on each of said **flow** **gates** of said□flow gate□ collection.
7 1
AMENDED SHEET (ARTICLE 19)
Amendment under Article 19 U1
Claims 62 to...

8/KWIC/6 **(Item 6 from file: 349)**

Fulltext Availability:
Detailed Description
Claims

Detailed Description
... A bus locally connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network...that different transformers may have differing transformer capacity limits.

These constrained flow elements are called **flow gates** . In the last few years the importance of **flow gates** has begun to emerge through the actions of NERC, which has been responsible for building a model estimating **flow gate** impact, which can be downloaded from their web site.

io A **flow gate** of a given AC power network will refer herein to a collection of at least one line whose total **maximum** safe **carrying capacity** will act as a congested element of the network, constraining AC power delivery between two...

...network.

All lines have maximum safe carrying capacities and thus could be considered 1 5 **flow gates** , of a sort. However, historical congestion analysis of specific AC power networks reveals that only a small number of **flow gates** account for almost all congestion problems. Such **flow gates** will be herein referred to as significant **flow gates** .

The associated AC **power transfer** across a given **flow gate** is additive due to the super positioning effects previously discussed. Thus in sending 100 megawatts along a path, the transmission may have a 1 0% impact on the **flow gate** , putting 10 megawatts on the **flow gate** . A second generator may have a 5% impact on that **flow gate** . Generating 100 megawatt at the second generator would add 5 across the **flow gate** .
Figure I depicts an exemplary AC power network based upon contemporary AC power technology as...commodities or the economic results of transactions involving ephemeral, fungible electrical commodities.

Consider how AC power transfers are managed today. Transmission rights are considered and negotiated in terms of point-to-point transfers within the 2o network known as contract paths. Such thinking is contrary to the previously discussed physics of these AC power networks...

...an essentially linear effect on all transmission lines in the network, and consequently impact all **flow gates** within that network to some extent.

This **contract** path system of scheduling power transmission reserves transmission rights along a particular, direct path through...

...making up the direct path. It often occurs that some constraint, occurring across a significant **flow gate** off that direct path, actually limits the transmission capability on the direct path.
00
The **contract** path system maintains the fiction that AC power can be directed to follow a path...

...one can mythically direct AC power a particular way through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with the **contract** path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.

Today's **contract** path is based upon a first-come, first-served priority scheme.

io What is bought...

...power transmission from A to B and bought a transmission from B to C. Using **contract** path approach, that does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning 1 5 power transmission from A to B and from...
...to
purchase separately transmission from A to C. this is because there might be some **flow gate** constraint which would not be met in the two separate paths
which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once you have purchased the transmission from A...the constraint, when a particular path becomes over-constrained, cuts are issued across apparently irrelevant **contracted**
paths to compensate. The central operator acts, because a **flow gate** will
overflow, forbidding transmission often across apparently irrelevant paths to compensate.

Another alternative approach is...

...limited amount of detailed information such a system can acquire, or use, to optimize AC **power transfers** . The **power** users are again blind to their options. The players
cannot determine what works best for...
...to imagine that such a situation could be optimal.

NERC has developed a methodology addressing **flow gates** to some extent.

3o This is discussed in a document entitled "Discussion Paper on Aligning ...

...shift to a system of reserving and scheduling transmission based on actual use of congested **flow gates** , which they called the FLOWBAT method. Their proposal suffers from a serious omission, it does not address the issue of allocating **flow gate** capacity when demand exceeds supply. By their silence on this issue, it appears that they...

...case called Transaction Participation Functions (TPFs).

These distribution functions refer to transmission paths rather than **flow gates** .

GAPP attempts to align compensation paid by transmission users with actual power flows. However, GAPP is strictly an after-the-fact settlement system. It 2o alters the current **contract** path scheme only to redistribute the revenue. It does not attempt to allocate scarce transmission...

...the physics of AC power networks. Further, since transmission rights are predominantly constrained by significant **flow gates** , what is needed should account for the effect on the significant **flow gates** for each **contracted** transmission. A method and mechanism is needed for trading generation and transmission rights in a...

...market interval time interval.

The product type of a market interval includes energy and AC **power transfer** .

2o The location of a market interval with an energy product type is a node...

...an AC power network node collection. The location of a market interval with an AC **power transfer** product type is from a first node ...further embodiments include an AC power network in the electrical power grid further containing a **flow gate** collection. For each **flow gate** of the **flow gate** collection, there is at least one market interval with AC **power transfer** product type and location of the **flow gate** . Such embodiments advantageously provide a trading mechanism for AC **power transfers** across **flow gates** , which is in keeping with the physical characteristics of AC power networks. Note that again, each of these market intervals are markets for ephemeral, fungible commodities, AC **power transfer** effects across a **flow gate** during a time interval.

io Certain other further embodiments includes electrical power grids further containing...

...second node of a second AC power network. The product type collection further includes DC **power transfers** . Market intervals with DC **power transfer** product types have locations the same as the DC power line. Such embodiments advantageously provide market for additional ephemeral, fungible commodities, DC **power transfers** over specific DC power lines during specific time intervals.

Certain embodiments include where each market...

...removing trading in market intervals which pass outside their window time interval.

Certain embodiments include **contracting** to create an agreed **contract** from the validated order collection. **Contracting** to create an agreed **contract** from the validated order collection further includes determining a first bid validated 1 5 order...

...terms of price to create an agreed price; calculating an agreed amount; creating the agreed **contract** for the first market interval at the agreed price for the agreed amount with first bid validated order and first ask validated order. Such embodiments advantageously support forming **contracts** based upon the validated orders of the virtual trading floor for the ephemeral, fungible commodities...
...and asks which are no longer active, since they have become bound by the agreed **contract** .

Certain further embodiments include removing the first bid validated order from a validated order containing...

...collection from order messages received from certified clients.

Certain further embodiments advantageously include extension of **contracting** to create an agreed **contract** from the validated order collection to include sending the ordering clients of the first bid validated order and the first ask validated order notice of the agreed **contract** .

Certain embodiments advantageously include extension of maintaining the market collection of market intervals to include...terms of price further includes calculating in terms of capacity option price. Creating the agreed **contract** for the market interval at the agreed price for the agreed amount includes the agreed capacity option price. Such embodiments advantageously provide for capacity option **contracting** of ephemeral, fungible commodities in the electrical power grid.

io In certain further embodiments, for...

...Figure 6B depicts a refinement of Figure 3B of a market interval of an AC **power transfer** product type in accordance with certain embodiments; Figure 7 depicts a validated order 1200 comprised...

...has passed;
Figure 10A depicts a detail flowchart of operation 2000 of Figure 4 performing **contracting** to create an agreed **contract** from said validated order collection;
Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from said validated order 1 5 collection;
Figure 11 A depicts a detail flowchart of...operation 2092 of Figure 1 OA performing notified biding and asking clients of the agreed **contract** for their respective validated orders;
Figure 17A depicts a detail flowchart of operation 2004 of...
...18C depicts a detail flowchart of operation 2120 of Figure 10B performing creating the agreed **contract** at the agreed price and the agreed io option price for the agreed amount whenever...

...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain embodiments.

Detailed Description of the Invention
Figure 3A depicts a...

...interval collection is a member of a product type collection comprised of energy and AC **power transfer** . In certain
@/ z
further embodiments, the location of a market interval having an energy product...

...power grid. In certain further embodiments, the location of a market interval having an AC **power transfer** product type ...are not limited to acoustic
interfaces to humans, audio and visual identification portals to the **contracting**
of AC **power transfer** regarding **flow gates** , encoding and decoding mechanisms used in long distance communication and interfaces to recording devices of agreed **contracts** .

A program code segment as used herein refers to instructions in a form executable or...Figure 6B depicts a refinement of Figure 3B of a market interval of an AC
power transfer product type in accordance with certain embodiments. The
product type 1110 of the market interval...

...Figure 6C depicts a refinement of Figure 6B of a market interval of an AC
power transfer product type in accordance with certain embodiments. The
product type 1 1 1 0 of...

...an Energy product type 1 1 1 0. The location 1 1 12 is a **flow gate** of the **flow gate** collection of a first AC power network contained in the electrical power grid. Note that **flow**
gates can represent a congestion constraint across more than one transmission line, and may not have...
...networks indicates each AC power network contained in the electrical power grid further contains a **flow gate** collection of **flow gates** . Each **flow gate** location being either from
an associated first node of the AC power network to an...

...in the case of a collection of constrained transmission lines, will be denoted by a **flow gate** designator. An AC **power**
transfer amount from nodel to node2 produces an amount of AC **power**
transfer across the **flow gate** as essentially an associated linear, skewsymmetric function of the amount from nodel to nodeZ for each of the **flow gates** of the **flow gate** collection. For each of the□flow□ **gates** of the **flow gate** collection, there is at least one market interval in the market interval collection of AC **power transfer** product type with the **flow gate** location.

In certain embodiments, each validated order of the validated order collection io with the AC **power transfer** product type of the associated market interval further contains an amount. In certain further embodiments, a validated order of AC **power transfer** product type from the first node to the second node is further comprised of a validated

order of the **flow gate** associated market interval. The amount ordered for that **flow gate** is essentially the associated linear, skew-symmetric function of the amount from the first node to the second node, for each of the **flow gates** of the **flow gate** collection.

Note that in certain further embodiments, there is a price associated with each validated order of the AC **power transfers** of the **flow gates** . In certain further embodiments, there is a price associated with the AC **power transfer** from the first node to the second node.

Figure 8A depicts a market interval of...

...second node of a second AC power network. The product type collection further comprises DC **power transfer** . For each DC power line of the DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with the location as the location of the DC power line.

2115
Figure...

...commodities.
Figure 10A depicts a detail flowchart of operation 2000 of Figure 4 performing io **contracting** to create an agreed **contract** from the validated order collection.

Arrow 2090 directs the flow of execution from starting operation 2000 to operation 2092. Operation 2092 performs **contracting** to create an agreed **contract** from the validated order collection. Arrow 2094 directs execution
from operation 2092 to operation 2096...

...commodities.

2o Figure 10B depicts a detail flowchart of operation 2092 of Figure 10A performing **contracting** to create an agreed **contract** from the validated order collection.

Arrow 2110 directs the flow of execution from starting operation...

...1
directs execution from operation 2116 to operation 2120. Operation 2120 performs creating the agreed **contract** for the market interval at the agreed price for the agreed amount whenever the first...
...certain embodiments, not all validated orders have a price associated with
them. Consider an AC **power transfer** from nodel to node2 of an AC power
network. Assume that AC power network has a collection of three **flow gates** .

io A validated order for an AC **power transfer** amount from nodel to node2 may contain validated orders for an associated amount for each **flow gate** of the
flow gate collection. Each of the **flow gate** validated orders may contain
prices for their respective **flow gate** . The agreed amount would be calculated based upon the associated amounts and pricing of the **flow gates** . In certain 1 5 other embodiments, all validated orders have a

price associated with them...interval collection is a member of a product type collection comprised of energy and AC **power transfer** . In certain further embodiments, the location of a market 1 5 interval having an energy...

...power grid. In certain further embodiments, the location of a market interval having an AC **power transfer** product type is from a first node of a ...by the first party to act on behalf of the first party with respect to **contracting** the AC **power transfer** .

Server system 3500 includes at least one server computer 3520 coupled to network 3200. Network...

...various personal optimizations and shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

In certain other further embodiments, server system 3500 includes...

...operation 2092 of Figure 1 OA performing notified biding and asking clients of the agreed **contract** for their respective validated orders.

Arrow 2270 directs the flow of execution from starting operation...

...2278 directs execution from operation 2276 to operation 2280. Operation 2280 performs sending a bid **contract** message based upon the agreed **contract** to the bid client. Arrow 2282 directs execution from operation 2280 to operation 2284. Operation 2284 performs sending an ask **contract** message based upon the agreed **contract** to the ask client. Arrow 2286 directs execution from operation 2284 to operation 2288. Operation...the capacity option price, besides just price of purchase. In agreeing to a capacity option **contract** , the seller is only guaranteed the earnings of the capacity option price, and the buyer...

...the optioned capacity, it is at the price already agreed upon in the 1 5 **contract** . The seller then makes additional income from the actual purchased amount at the agreed price...

...18C depicts a detail flowchart of operation 2120 of Figure 10B performing creating the agreed **contract** at the agreed price and the agreed option price for the agreed amount whenever the...

...of execution from starting operation 2120 to operation 2372. Operation 2372 performs creating the agreed **contract** for the market interval at the agreed price and the agreed option price for the...by the first party to act on behalf of the first party with respect to **contracting** the AC **power transfer** .

As shown in Figure 1 5, server system 3500 includes at least one server computer...

...various personal optimizations and shortcuts, including but not limited to macro style functions and standard **contract** forms employed by the client 1400.

In certain other further embodiments, server system 3500 includes... various personal optimizations and shortcuts, including, but not limited to,
macro style functions and standard **contract** forms employed by the client
3190.

As shown in Figure 15, in certain other further...1998. The current market price in dollars per megawatt
hour 4010 is "12.96". The **contracted** position in net megawatts 4012 is "12.00". The pending position in net megawatts 4014...
...5 position in net megawatts 4016 is "25.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net
megawatts-hours...

...market price in dollars per megawatt-hour 41 1 0 is 1 6.72". The **contracted** position in net megawatts 4112 is "1 0.00". The pending position in net megawatts...

...position in net megawatts 4116 is 1 0.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours...

...computer showing an ordering screen for hourly time interval based market intervals for a specific **flow gate** market in accordance with certain embodiments.

The displayed information 4200 includes a variety of fields, including field 4202, where a specific **flow gate** or intertie may be selected. Immediately below that field is a field which specifies commodity...

...has a succession of
rows with entries from 1 to 24, indicating the hourly AC **power transfer**
markets 4204 in the **flow gate** location "COCOPP Unit 1" 4202. Consider the row labeled by the hour 4208 ending at "3". This row displays the market state of the market interval with AC **power transfer** product type, **flow gate** io 4202 location and hour time interval ending at 1:00 for May 10, 1999. The
current market price in dollars per megawatt-hour 4210 is "O.00". The **contracted** position in net megawatts 4212 is "O.00". The pending position in net megawatts 4214...

...total position in net megawatts 4216 is "O.00", which is the sum of the **contract** and pending positions for that market interval. The **contracted** flow 4224 is "O.00". The pending flow 4226 is "O.00".

The total flow...

Claim
... interval collection is a member of a product type collection comprised of energy and AC **power transfer** ;
wherein said location of a market interval of said market interval collection having said energy...

...wherein said location of a market interval of said market interval collection having said AC **power transfer** energy product type is from a first of said nodes of said node collection of...

...2,
wherein an AC power network contained in said electrical power grid further contains a **flow gate** collection of **flow gates** , each□flow□ **gate** location
being from an associated first node of said AC power network to an associated second node of said AC power network;
wherein for each of said **flow gates** of said **flow gate** collection, there is at least one associated market interval in said market interval collection of AC **power transfer** product type with said **flow gate** location.
4 The method of Claim 1,
wherein said electrical power grid further contains a...

...a second AC
1 5 power network;
wherein said product type collection further comprises DC **power transfer** ; and
wherein for each DC power line of said DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with said location as said location of said DC power line.

5 The...

...market interval of said validated order.
2o 8. The method of Claim 1, further comprising
contracting to create an agreed **contract** from said validated order collection comprising
determining a first bid validated order associated with a...

...said first bid validated order and first ask validated order; and
56
creating said agreed **contract** for said first market interval at said agreed price for said agreed amount whenever said...upon said first bid validated order and first ask validated order;
wherein creating said agreed **contract** for said market interval at said 2o agreed price and said agreed option price for said agreed amount includes
creating said agreed **contract** for said market interval at said agreed price and said agreed option price for said...

...order client contained in said validated order collection.

13 The method of Claim 12,
wherein **contracting** to create said agreed **contract** from said validated
order collection further comprises
extracting from said first bid validated order to...

...extracting from said ask validated order to create an ask certified client;
sending a bid **contract** message based upon said agreed **contract** to said bid client;
sending an ask **contract** message based upon said agreed **contract** to said ask client.

14 The method of Claim 8,
wherein each of said market...

...interval collection is a member of a product type collection comprised of energy and AC **power transfer** ;
wherein said location of a market interval of said market interval collection having said energy...

...wherein said location of a market interval of said market interval collection having said AC **power transfer** energy product type is from a first 3o node of said node collection of a...

...18,
wherein an AC power network contained in said electrical power grid further contains a **flow gate** collection of **flow gates** , each□flow□ **gate** location
being from an associated first node of said AC power network to an associated second node of said AC power network;
wherein for each of said **flow gates** of said **flow gate** collection, there is at least one associated market interval in said market interval collection of AC **power transfer** product type with said **flow gate** location.

20 The program operating system of Claim 17,
wherein said electrical power grid further...

...node of a second AC
power network;
wherein said product type collection further comprises DC **power transfer** ; and
wherein for each DC power line of said DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with said location as said location of said DC power line.

21 The...

...24 The program operating system of Claim 17, further comprising
a program code segment supporting **contracting** to create an agreed **contract** from said validated order collection comprising:
61
a program code segment supporting determining a first...
...validated order and first ask validated order;
a program code segment supporting creating said agreed **contract** for said first market interval at said agreed price for said agreed amount io whenever...

...2o 29. The program operating system of Claim 28,
wherein said program code segment supporting **contracting** to create an agreed **contract** from said validated order collection further comprises
a program code segment supporting extracting from said...

...order to create an ask certified client;
a program code segment supporting sending a bid **contract** message based upon said agreed **contract** to said bid client; and
a program code segment supporting sending an ask **contract** message 3o based upon said agreed **contract** to said ask client.
6@
. The program operating system of Claim 24,
wherein each of...interval collection is a member of a product type collection
comprised of energy and AC **power transfer** ;
wherein said location of a market interval of said market interval

collection having said energy...

...wherein said location of a market interval of said market interval collection having said AC **power transfer** energy product type is from a first node of said node collection of a first...

...34,
wherein an AC power network contained in said electrical power grid further contains a **flow gate** collection of **flow gates** , each□flow□ **gate** location
being from an associated first node of said AC power network to an associated second node of said AC power network;
wherein for each of said **flow gates** of said **flow gate** collection, there is at least one associated market interval in said market interval collection of AC **power transfer** product type with said **flow gate** location.

36 The computing system of Claim 33,
wherein said electrical power grid further contains...

...node of a second AC
power network;
wherein said product type collection further comprises DC **power transfer** ; and
wherein for each DC power line of said DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with said location as said location of said DC power line.

37 The...of Claim 33,
wherein said program operating system further comprises
a program code segment supporting **contracting** to create an agreed **contract** from said validated order collection comprising;
a program code segment supporting determining a first bid...

...order and first ask validated order; and
a program code segment supporting creating said agreed **contract** for said first market interval at said agreed price for said agreed amount
69
whenever...

...maintaining said validated
order collection of said validated orders; and
said program code segment supporting **contracting** to create an agreed **contract** from said validated order collection.
io 48. The computing system of Claim 47,
wherein said segment supporting **contracting** to create an agreed **contract** from said validated order collection.
2o 49. The computing system of Claim 48,
wherein said...

...computer system.

50 The computing system of Claim 44,
wherein said program code segment supporting **contracting** to create said agreed **contract** from said validated order collection further comprises:
a program code segment supporting extracting from said...

...order to create an ask certified client;
a program code segment supporting sending a bid **contract** message

based upon said agreed **contract** to said bid client; and
a program code segment supporting sending an ask **contract** message
based upon said agreed **contract** to said ask client.

51 The computing system of Claim 44,
wherein each of said...
...validated order and first ask validated
order;
said program code segment supporting creating said agreed **contract**
for said market interval at said agreed price and said agreed option
price for
io said agreed amount includes
said program code segment supporting creating said agreed **contract**
for said market interval at said agreed price and said agreed option
price for
said...
?

```
Set     Items   Description
S1          0   (GREENE (2N) SCOTT) (10N) MARGIN (10N) SENSITIVITY
S2        136   (GREENE (2N) SCOTT)
S3      14609   1 AND MARGIN AND SENSITIVITY
S4          0   S1 AND MARGIN AND SENSITIVITY AND TRANSFERS
S5          2   BLACKOUTS AND (FLOW (2N) GATE?) AND (POWER (2N) TRANSFER??-
              ?)
S6         19   (FLOW (2N) GATE?) AND (POWER (2N) TRANSFER???) AND CONTRAC-
              T???
S7       1149   MAXIMUM (10N) CARRYING (10N) CAPACITY
S8          6   S6 AND S7
?
```

T S8/9/1

Invent.

8/9/1 (Item 1 from file: 349)
DIALOG(R)File 349:PCT FULLTEXT

00987961

METHOD AND APPARATUS FOR USING A TRANSACTION SYSTEM INVOLVING FUNGIBLE, EPHEMERAL COMMODITIES INCLUDING ELECTRICAL POWER

PROCEDE ET APPAREIL METTANT EN OEUVRE UN SYSTEME DE TRANSACTION DE BIENS FONGIBLES EPHEMERES COMPRENANT L'ENERGIE ELECTRIQUE

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(EP) AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LU MC NL PT SE SK TR
(OA) BF BJ CF CG CI CM GA GN GQ GW ML MR NE SN TD TG
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English Abstract
A method and apparatus is disclosed for using a transaction system involving fungible, ephemeral commodities including electrical power, the transmission of electrical power, trading such commodities, managing user resources and credit resources, as well as managing compliance reporting of these activities.

French Abstract
L'invention concerne un procede et un appareil qui mettent en oeuvre un systeme de transaction de biens fongibles ephemeres comprenant l'energie electrique, l'acheminement de l'energie electrique, le commerce desdits biens, la gestion de ressources d'utilisateurs et de ressources de credit, ainsi que la gestion des comptes rendus de conformite concernant ces activites.

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Detailed Description
METHOD AND APPARATUS FOR USING A TRANSACTION
SYSTEM INVOLVING FUNGIBLE, EPHEMERAL COMMODITIES
INCLUDING ELECTRICAL POWER

Technical field
This invention relates to using a transaction system for trading, operational
scheduling, and settling transactions involving ephemeral, fungible commodities with regards to electrical power as applied to grids of one or more AC power networks.

Backaround Art
The United States and, in particular, the state of California find themselves in a state of crisis regarding the availability and cost of electrical power. Many experts are investigating this crisis, including the inventors. Several primary problems contribute to that crisis.

1 . The electrical power grid has seen almost no new electrical power generation capacity added in years.

2. Tools to optimally manage electrical consumption are antiquated and insensitive to changing consumption and cost patterns in real time, often amounting to no more than simple manual switches. While turning off unused equipment such as electric lights has been useful, it does not help the facility managers who must make decis ions based upon plans encompassing the facility needs, such as producing
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products to sell and providing hot water and comfortable room temperatures in hotels.

3. The system of transmitting electrical power, particularly AC electrical power has significant congestion paths, known herein as **flow gates** .

There has been little economic incentive to increase the transmission capacity through the **flow gates** , in part because there is no coherent policy provided fair and predictable economic return to the required capital investments.

4. Deregulation in the California energy industry brought many things with
it, including a restriction to only short-term energy **contracts** . As the older, long term **contracts** ended, this left the bulk of the state's energy
costs vulnerable to daily market fluctuations and led to the prices on the spot market dominating the cost of energy not only in California, but throughout the United States.

Regarding adding electrical power generation capacity. Many large facilities are unwelcome in the neighborhoods where they may be built, due to pollution and a lack of esthetic appeal. Up until recently, this was cited as the primary reason for little new power capacity.

One promising alternative is power generation associated with an existing facility. Many facilities can produce large quantities of burnable fuel, which could be used to generate electricity. Such facilities include, but are not
limited to, municipal waste treatment plants, commercial livestock farms raising hogs and/or chickens, feed lots, saw mills, as well as farms raising vegetable matter, such as corn and sorghum. It is in the public interest that
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such facilities produce electrical power. Additionally, other facilities, including breweries, refineries and chemical plants, can produce

electricity from steam, heated fluids or other gases, and/or heat already required by the facility.

These new facilities face must figure out how to manage such an endeavor without incurring a large management overhead. Today's power management procedures and technology is based upon large facilities, often generating hundreds of megawatts. Such facilities often require three shifts of operations staff, each of which may number a dozen or more people. These facilities also require energy traders, scheduling experts and an accounting staff to finalize
lo and oversee the settlements phase. This management process is too expensive for a facility that sells power on the order of a megawatt. What is needed is a tool supporting all these management functions at a fraction of the overhead of contemporary methods.

Existing management systems for large generation facilities face a problem in
reliably communicating between all these different necessary management functions. Usually the reliability error is in the interfaces between different
management subsystems. What is needed is a unified mechanism supporting all the primary management activities discussed above, providing a consistent, easy to use tool for organizing the activities and communicating the results of the various managerial agents of a large generation facility.

As used herein, a fungible commodity refers to a commodity traded strictly in
terms of the quantity of that commodity. No single unit of a fungible commodity is distinguishable from another unit of that commodity. A kilowatthour of 60 Hz AC power delivered on a power line is not distinguishable from another kilowatt-hour delivered at the same time to the same place on the
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same line. An ephemeral, fungible commodity is a fungible commodity whose existence is extremely short-lived. Electrical power generation, network bandwidth, seats on an airplane and entry slots onto a freeway during rush hour are all examples of fungible commodities which exist but for a short duration of time. In contradistinction, starting lots in an assembly line produce tangible results, which may differ widely in content, thus showing an example of an ephemeral, non-fungible commodity.

There are some basic physical properties of electrical power distribution which are important to understand. An AC power network is an electrical network lo connecting AC power generators to AC power loads on power lines controlled
so that the network as a whole can be seen to function at an essentially constant frequency and uniform phase across the network. Drifts in phase are compensated by- phase shifting devices to enforce the uniform phase property
across the AC power network. Drifts in frequency are compensated at the generators. Such frequency variations are typically caused by variances between the loads and generated power. The effect of these compensations is to operationally provide essentially constant frequency and uniform phase throughout the AC power network.

The AC power distribution frequency in the United States, Canada, Mexico 2o and some other countries is 60 Hz and in some other countries is 50 Hz. In certain cases, the power is distributed in a 2-phase transmission scheme. In certain other instances, the power is distributed in a 3-phase

transmission scheme.
A grid as used herein refers to an electrical power system which may comprise more than one AC power network as, well as DC power lines which
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may transfer energy between nodes of different AC power networks or between nodes of a single AC power network.

Cities, generators and the like act as the nodes of an AC power network.
A
specific node may comprise more than one generator or load. A bus connects these local facilities of a node. High voltage AC transmission lines **transfer power** between the cities and the generators in major load centers of an AC power network.

By way of example, in the United States, there's an AC power network called the Western States Coordinating Council, which covers British Columbia in lo Canada down to Northern Mexico and over to the Rocky Mountains. There's
another AC power network in Texas and there is another AC power network essentially covering the rest of the United States and Canada, with the exception of a portion of Quebec. These three AC power networks are connected together by direct current lines to form the North American grid.
They are not connected in AC. They are asynchronous, in that they are not synchronized either in terms of frequency or phase across the United States, Canada and northern Mexico.

Electrical power generation can be readily seen to be ephemeral and fungible.

One kilowatt is reasonably treated the same as another, persisting only a 2o relatively short period of time. Electrical power transmission can also be seen as ephemeral and fungible. Electrical power transmission is most commonly performed as AC transmission lines between nodes of an AC power network.

DC power lines are used additionally to connect specific nodes of 'either a single AC power network or nodes of distinct AC power networks.

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Electrical power storage is of typically limited time duration. The most commonly used storage system is to pump water uphill to a storage site where it is held until needed. When needed, it is gravity-fed through one or more turbines to generate electricity. Such systems, for economic reasons, are not used to store power for very long, often for no more than a day or two.

It should be noted that the interface points for power into such systems are ephemeral and fungible.

Power switching between lines involving high power (megawatts and above) is not commonly done. Current examples of AC power switching include lo switching between amplifiers and antenna feeds in broadcast radio systems, and typically involve no more than a fraction of a megawatt. While there are
some high power AC switches, they are large and expensive devices. High power AC switches rarely change state. Note that the power traversing the interfaces of such switches to a power network are ephemeral and fungible.

There are some basic physical properties distinguishing AC power distribution systems from other flow-based systems such as DC power, gas, water and oil
transmission systems. AC power networks differ from gas, water, oil and other fluid flow distribution systems in that changes in power generation and loading propagate across such networks at approximately the speed of light.
2o The effect of power generation and power loading effects the whole AC power network in a manner that, for practical purposes, is simultaneous.

Due to the stability of frequency and phase across an AC power network, changes in power have a super positioning effect. This insures that the power being carried on any line in the network is essentially a linear function of the generators and loads on the network, Furthermore, if a path of lines connects
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two nodes, generating power at the first node carried by the path is offset by
power generated at the second node, as related by the above mentioned linear function.

These AC power networks are operated within a safe range, so that the patterns of flows are fairly predictable, given the configuration of the network does not change. The National Electric Reliability Council computes a system of a set of numbers -called **power transfer** distribution factors available on the North American Reliability Council website, www.nerc.com, showing how the power is distributed across these various lines. It is a linear function of the io amount injected, which changes sign when the direction of transfer changes
from Nodel to Node2 into Node2 to Nodel. Such functions are skew symmetric with respect to the nodes.

Consider a DC network: one can directly control the delivery of power from
one point to another. This cannot be done on AC power networks. It, is a characteristic of AC power networks that all lines are affected in roughly fixed proportions, sometimes referred to as "transfer distribution factors" and by the generating and loading at specific nodes.

By way of example, when AC power is sent from Bonneville Power Authority in the state of Washington to San Francisco, some of it comes down the direct
path and some of it comes down through Idaho to Arizona and back up from Southern California to Northern California.

One may be limited in what can be brought from the Bonneville Power Authority to San Francisco because there's a problem with the flow coming up
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from Southern California to Northern California. Please note, this particular path, known as Pathl 5, is often the first path to become congested.

These constrained flow elements are called flowgates. A flowgate of a given AC power network refers herein to a collection of at least one line whose total **maximum** safe **carrying capacity** acts as a congested element of the network, constraining AC power delivery between two or more nodes of that network.

Historical congestion analysis of specific AC power networks reveals that only a small number of flowgates account for almost all congestion problems.

Such flowgates are herein referred to as significant flowgates. Path15 is io considered a significant flowgate.

The associated AC **power transfer** across a given flowgate is additive due to
the super positioning effects previously discussed. Thus, in sending 100 megawatts along a path, the transmission may have a 10% impact on the flowgate, putting 10 megawatts on the flowgate. A second generator may have a 5% impact on that flowgate. Generating 100 megawatt at the second generator would add 5 niegawatt across the flowgate.

Figure 1 A depicts an exemplary AC power network based upon contemporary AC power technology as found in the prior art. The network contains 12 nodes labeled 10, 20, 303 40; 50; 60, 707 80, 90; 1100@ 110 and 120 respectively.

AC transmission line 12 runs between node 10 and node 20. Line 14 runs between node 10 and node 40. Line 22 runs between node 20 and node 30.

Line 36 runs between node 30 and node 40. Line 42 runs between node 40 and node 120. Line 44 runs between node 40 and node 60. Line 46 runs
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between node 40 and node 50. Line 52 runs between node 50 and node I 1 0.

Line 54 runs between node 50 and node 60. Line 56 runs between node 50 and node 70. Line 62 runs between node 60 and node 1 1 0. Line 64 runs between node 60 and node 70. Line 82 runs between node 80 and node 90.

Line 92 runs between node 90 and node 120. Line 94 runs between node 90 and node 1 1 O.. Line 96 runs between node 90 and node 1 00. Line 102 runs between node 1 00 and node 1 1 0. Line 11 2 runs between node 1 1 0 and node 120.

Flowgate A 210 is a constraint on the network. Lines 32, 34 and 42 are io constrained by flowgate A 210 by a total **maximum** safe **carrying capacity** , in
that these lines have transmission **capacity** limitations which are easily
overloaded when this **maximum** safe **carrying capacity** is exceeded.

Flowgate B 220 is a constraint on the network. Lines 42 and 4 4 are constrained by flowgate B 220.

Flowgate C 230 is a constraint on the network. Lines 52 and 62 are constrained by flowgate C 230 to a total **maximum** safe **carrying capacity** .

By way of example, a mountain range such as the Cascade mountain range in the state of Washington might have a limited number of passes. The transmission lines through each mountain pass may form a single flowgate.

2o Flowgates A 2102 B 220 and C 230 illustrate the overall effect that might result for transmission paths through three mountain passes. Another problem, as yet addressed, is revenue sharing between multiple vendors supporting energy transmission along a flow path. By way of example, consider one of the few passes through the Cascade mountain

range located in the state of Washington. Through each of these narrow corridors runs one or more strips of land populated by power transmission towers and high voltage power lines. The AC power transmitted on these power lines is frequency and phase matched. The collection of these AC power lines may create a single system constraint, a flowgate.

By way of example, suppose there are three transmission lines between two nodes in an AC power network, each individually capable of carrying 100 megawatts. These three transmission paths may collectively form a flowgate, which has a collective transmission limit of 200 megawatts, even though the io sum of the three transmission lines is 300 megawatts.

Assume that some group of investors wants to finance a new set of towers supporting one or more transmission lines through this mountain pass. The now transmission facility will in all probability become part of the flowgate of
transmission lines through that mountain pass from the moment it becomes i5 operational. The question: How are flowgate transmission revenues to be
shared when more than one group has made the capital investment to support such transmission? Note that if investors cannot reasonably predict a fair return on their investment, they will be unlikely to make the investment.

What is needed is a mechanism providing incentives to groups seeking to add transmission capabilities through fair and predictable revenue sharing from flowgate transmission revenues.

Figure 1 B depicts a list of associated AC power functions described by their coefficients for each flowgate of a collection of flowgates for each of the
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busses of the various nodes of the exemplary AC power network of Figure 1 A as disclosed in the prior art.

Note that these AC power functions are essentially linear and can be described by their coefficients.

Bus 1 locally connects all facilities of Node IO. Bus 2 locally connects all facilities of Node 20. Bus 3 locally connects all facilities of Node 30. Bus 4 locally connects all facilities of Node 40. Bus 5 locally connects all facilities of Node 50. Bus 6 locally connects all facilities of Node 60.

Bus 7 locally connects all facilities of Node 70. Bus 8 locally connects all facilities of Node 80. Bus 9 locally connects all facilities of Node 90. Bus 10 locally connects all facilities of Node 1 00. Bus 1 1 locally connects all facilities of Node 1 10. Bus 12 locally connects all facilities of Node 120.

Note that the facilities at these nodes, connected by the associated buss, often vary greatly in terms of generation capacity as well as loading capacity.

By way of example, a city often consumes far more AC power than it generates. Another example, a node for a major hydroelectric dam such as Grand Coulee Dam would tend to generate far more AC power than it consumed.

Note that the associated AC power functions for the various busses are all fractions of 1, since the most power that could be transferred is the amount of
power at the generation node. Note further that some of these AC power functions are negative. Bus 11 has strictly zeroes for its power function. It is essentially acting as a reference node for calculating the associated functions.

When electricity is generated at Bus 1 and consumed at Bus 1 1 , the values in
1 1
the first row of Figure 2 indicate the ratio of **power transferred** across
flowgates A, B, and C. If the power is generated at Bus 1 1 and consumed at Bus 1 , the same values apply but are of reversed sign.

Consider how AC **power transfers** are managed today in most of North Amerca. Transmission rights are considered and negotiated in terms of pointto-point transfers within the network known as **contract** paths. Such thinking is contrary to the previously discussed physics of these AC power networks, because changes in power generation or load at any node have an essentially linear effect on all transmission lines in the network, and consequently impact lo all flowgates within that network to some extent.
The **contract** path system maintains the fiction that AC power can be directed to follow a path through the network chosen as one might with natural gas.

By changing the valves, one can mythically direct AC power a particular way
through the AC power network. The **contract** path system was put in place because it was thought conceptually easier since one only had to make reservations along the single path. The fundamental problem with, the **contract** path approach is that the **contract** path arrangement for transmission does not accord with the way the power actually flows in an AC power network.

Today's **contract** path is a first-come, first-served priority scheme. What is 2o bought has very limited resale capability. By way of example, consider three
nodes A, B and C forming a triangle in an AC power network. Suppose one bought a power transmission from A to B and bought a transmission from B to
C. Using the **contract** path approach, does not mean one owns the power transmission from A to C, because **contract** paths are not additive. Owning
power transmission from A to B and from B to C would not entitle power
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transmission from A to C. To transport from A to C, one would have to purchase separately transmission from A to C. this is because there might be some flowgate constraint which would not be met in the two separate paths
which would be triggered in the combined path. So in the **contract** based market, which is the traditional market, once you have purchased the transmission from A to B, it's only value is for moving energy from A to B.

Today, there are several ad hoc approaches to limiting flow on one path because of the impact on another path. These **contract** path approaches ignore the physics of AC power networks. This leads to situations where

even io though some other path may actually be the constraint, when a particular path
becomes over-constrained, cuts are issued to compensate. The central operator acts, because a flowgate will attempt to exceed its safe carrying -capacity, forbidding transmission often across apparently irrelevant paths to
compensate. The result is market chaos, since participants do not have
115 reasonable assurance that their deals will actually go to delivery. Another alternative approach is to take all of these generator costs, and the
preferences of the buyers, into a mathematical optimization program, and figure out the optimal flow. This alternative approach has significant disadvantages. In a commercial market, getting people to reveal all their costs is quite difficult. Most people are very reluctant to do that. Further, such costs frequently change. The loads have to reveal their preferences between
consuming and non-consuming players, which is a tremendous informational burden. It is extremely unlikely that they could or would do it. Even if they
did, all this information is a tremendous burden on the central operator collecting all the information.

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Such an alternative approach requires two-way communication among all the players, with all these devices and systems to control, when the people consume power and when they turn on and off these distributed devices. It has proven impossible to provide the requisite level of reliable communication and direct control systems. Besides, people are unwilling to turn over control of their business lives to a central operator. Another approach in industry is used by a system operator called PJM, for Pennsylvania, New Jersey and Maryland, who have developed a system called Locational Marginal Pricing (LMP). It is a central dispatched io methodology. However, a local flow model is buried within it. It supports some centralized management of generators, related equipment and facilities in order to get a consistent solution that is based upon the power distribution matrix. This is a matrix of all **power transfer** distribution factors between nodes of the AC power network.

This approach suffers from at least the same problems facing any other centralized control scheme. There is a very limited amount of detailed information such a system can acquire, or use, to optimize AC **power transfers** . The **power** users are again blind to their options. The players
cannot determine what works best for them. The central operator dictates to them. This situation is not optimal. Also, under LIMP, prices are not known until after the deal is done, which may be at the time of delivery or day ahead of delivery. Generation operators do not obtain the information they need to plan their hydroelectric, maintenance, and unit commitment decisions. Nor can price risks be easily hedged.

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NERC has developed a methodology addressing flowgates to some extent.

This is discussed in a document entitled "Discussion Paper on Aligning Transmission Reservations and Energy Schedules to Actual Flows", distributed in November, 1998 by the NERC Transaction Reservation and Scheduling Self-Directed Work Team. This team proposed an electrical power industry shift to a system of reserving and scheduling transmission based on actual use of congested flowgates, which they called the FLOWBAT method. Their proposal suffers from a serious omission, it does not

address
the issue of allocating flowgate capacity when demand exceeds supply. By io their silence on this issue, it appears that they would continue the current practice of first-come, first-served allocation. The flaws discussed above for centralized planning continue to be relevant in this approach.

Certain economists have expressed reservations with a flowgate market model utilizing a limited number of flowgates. They believe that leaving any
flowgates out of the system, even minor ones, introduces gaming opportunities, which will cause the RTO to incur costs that must be paid by everyone. However, flowgates are numerous, and may arise unpredictably. It
may not be feasible to trade every flowgate, as would be required to overcome the potential for gaming.

2o Supporting a large number of flowgates in a market model leads to several other problems. First, there is the technical problem of providing a user interface that makes it possible for users to cope with the complexity of numerous flowgates.

Second, there is the problem of maintaining liquidity with this many flowgates.

Customers want to buy and sell the bundles of flowgates they need to move
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energy from one point in the network to another. They may not feel comfortable posting bids and offers for individual flowgates without an assurance that they will be able to buy or sell the remaining flowgates they need for their bundle at a reasonable price. If everyone withholds bids and offers from the market until they see bids and offers for all the flowgates they want to buy or sell, the market could significantly lack liquidity.
What is needed is a method of using a market model supporting large numbers of flowgates and providing users with a straightforward method of trading the AC **power transfer** , while discouraging gaming opportunities.

io What is needed is a system supporting trading transmission rights and quantities of fungible ephemeral commodities in the form of complete bundles.

These complete bundles would allow purchase of delivered energy with one transaction. The system should permit the bundles to be internally large and complicated, supporting trading in every flowgate right, and potential flowgate
right and providing users with straightforward trading mechanisms for AC **power transfer** . Such trading mechanisms insure compliance with flowgate
constraints, and thus the physics of AC power networks, while discouraging gaming opportunities.

LIVIP accomplishes this, but does so at a cost of forcing participants to trade 2o FTRs at a limited number of discrete times. What is needed is an approach combining the flexibility of LIVIP with the benefits of true continuously traded forward markets.

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While certain RTO's like the- flowgate concept, they often do not want

the responsibility for identifying a small number of commercially significant constraints. They want the market to identify the significant constraints.

To summarize, what is needed is a method of using a transaction system for electrical ephemeral, fungible commodities optimizing the trading, scheduling, congestion management, ancillary services, metering, billing and settlements of accounts for electrical grids. Such a system and the methods !of its use
should support the needs of coordinating the management of a large enterprise as well as encourage the entry of small facility operators into the
lo power generation, transmission business, as well as aid consumption management by electrical power consumers.

Summary of the invention
The presently preferred embodiment of the invention fulfills at least the requirements and needs discussed with regards to the prior art. The invention includes methods and apparatus support the certified client initiating at least one action in the transaction system; as well as use of at least two of the following: Managing a user resource collection; Managing a bilateral trading portfolio; Managing a market position portfolio; Managing a market trading collection; Managing a credit resource collection; And managing compliance 2o reporting based upon at least one of the collection comprising the user resource collection, the market position portfolio, the bilateral trading portfolio, and the market trading collection.

The market trading collection is comprised of at least one market trade. A market trade involves a market interval with a product type, location and time
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interval, as well as at least an amount and a price. A market trade may be either an ask and/or a bid and/or a commitment regarding the market interval, amount and price.

The market position portfolio is comprised of at least one market position
summary for at least one market interval, which summarizes open bids and asks for that market interval. The market position portfolio may include market position summaries for market intervals that differ in at least one of the following: product type, location and/or at least one time interval. Presentation
of the market position summary may include the summary of bid and ask lo prices and amounts, as well as presentation of product type, location and time interval(s). When the certified client is a trader, it preferably supports
simultaneous presentation of the market position summary and trading position for at least one market interval.

Note that the apparatus may include, but is not limited to, one or more computers implementing the methods as program systems, as well as mechanisms which lack program pointers, thus program steps.

The invention advantageously provides for greater integration of management tasks, thereby reducing potential errors encountered at interfaces between various tools individually performing these tasks.

The invention further advantageously provides a uniform user interface to aid

operators in the extremely complex task of trading fungible, ephemeral commodities, including, but not limited to, DC and AC electricity, AC **power transfers** , flowgate rights, and point-to-point AC **power transfer** rights with bundled flowgate transmission rights.

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The invention advantageously provides a seamless integration from trading, through scheduling and into operational control of the equipment found in an AC power network, or more generally, in a grid containing at least one AC
power networks. Such embodiments offer cost efficient management systems to existing, as well as potential, energy consumers, energy producers, and transmission operators.

Brief Description of the Drawings
Figure 1 A depicts an exemplary AC power network based upon contemporary AC power technokogy as found in the prior art;
io Figure 1 B depicts a list of associated AC power functions described by their coefficients for each flowgate of a collection of flowgates for each of the busses of the various nodes of the exemplary AC power network of Figure 1 A
as disclosed in the prior art;
Figure 2A depicts various certified clients, 3100, 3120, 3140, and 3160-3180,
controlling a means for using 5000 a transaction system 6000;
Figure 2B depicts a simplified block diagram in which the mean 5000 for using
means supporting transaction system 6000 includes a transaction system 3000 comprised of at least one computer communicatively coupled with the certified client(s) and controlled by program system(s) made up of program
steps residing in accessibly coupled 3022 memory 3026;
Figure 2C depicts a refinement of transaction system 3000 as a system diagram in Figure 2B;
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Figure 2D depicts a refinement of transaction system 3000 as a system diagram in Figure 2C;
Figure 2E depicts a grid management system providing functions and services for grid market operations including a collection of client computers 37007 3720, 3740, 3760 and 3780 respectively coupled through network 3200
to server system 3500 including server computer 3520, and web server computer 3560, as well as server computer 3580 and database engine 3590;
Figure 2E depicts a collection of client computers 3700, 3720, 3740, 3760 and 3780 respectively coupled through network 3200, as depicted in Figure 2E,
io with further refinements showing a program system 4000 supporting communicating with one or more members of the engine system, as well as encryption devices;
Figure 3A depicts a virtual trading floor 1000, containing validated orders and
market intervals with associated market states and further containing a certified client collection of certified clients;
Figure 3B depicts a market interval containing a product type, location and
time interval;
Figure 3C depicts a refinement of a market interval as depicted in Figure 3B
further containing multiple time intervals;
Figure 3D depicts a macro market interval 1500 for a fungible, ephemeral

commodity from Figure 3A;
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Figure 4 depicts a detail flowchart of operation 5000 of Figure 2A-2E for method of a certified client interactively using a transaction system supporting
transactions involving at least one fungible, ephemeral commodity;
Figure 5A depicts a detail flowchart of operation 5012 of Figure 4 for the
certified client initiating the action in the transaction system;
Figure 5B depicts a detail flowchart of operation 5212 of Figure 5A for the
certified client responding to the financial commitment presented by the transaction system;
Figure 6A depicts a validated order 1200 of the validated order collection; io Figure 6B depicts a refinement of Figure 6A of a validated order 1200 of the
validated order collection;
Figure 7A depicts a refinement of Figure 3B of a market interval of an energy
product type;
Figure 7B depicts a refinement of Figure 3B of a market interval of an AC **power transfer** product type;
Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power transfer** product type;
Figure 7D depicts a refinement of Figures 7B and 7C of a market interval of
an AC **power transfer** point- to-point product type;
2o Figure 8 depicts a validated order 1200 comprised of at least two validated
orders, each with an associated market interval;
Figure 9A depicts a market interval of a DC power line;
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Figure 9B depicts market -interval II 00 of Figure 3B further containing a window time interval during which the market interval is active only within the
window time interval;
Figure 9C depicts market interval I 1 00 of Figure 9B containing a window time
interval and multiple time intervals;
Figure 10 depicts a view of certified client user interface 7000 showing an ordering screen with hourly time interval based market intervals for a specific
energy market;
Figure 11 depicts a view of certified client user interface 7100 showing an io ordering screen for daily on-peak time interval based market intervals for a
specific energy market;
Figure 12 depicts a view of certified client user interface 7200 showing an ordering screen for hourly time interval based market intervals for a specific
flowgate market;
Figure 13 depicts a view of certified cliebt user interface 7300 showing an ordering screen for hourly time interval based market intervals with respect to a specific facility ("Hyatt Generation") including energy transmission costs
from multiple displayed markets;
Figure 14 depicts a view of certified client user interface 7400 showing an ordering screen for hourly time interval based market intervals from a trade
book perspective;

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Figure 15 depicts a view of certified @Iient user interface 7500 showing an overview trading position for specific hours of two successive days including
the trade book and a limited number of certified clients;
Figure 16 depicts a detailed view of certified client user interface 7600 showing the trading position for specific hours of two successive days with
regards to one certified client based upon Figure 15;
Figure 17 depicts a view of certified client user interface 7700 providing an
overview of the reports on transactions and/or schedules available for presentation to the user;
io Figure 18 depicts a view of certified client user interface 7800 providing a detailed view of the monthly invoice for the certified client including fees to the
transaction engine service provider, who may be a first party, (APX Fees 7802);
Figure 19 depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource;
Figure 20A depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource;
Figure 20B depicts a detail flowchart of operation 5452 of Figure 20A for creating the first knowledge interval;
2o Figure 21A depicts a detail flowchart of operation 5022 of Figure 4 for
managing the user resource;
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Figure 21B depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource;
Figure 21C depicts a detail flowchart of operation 5192 of Figure 5A for the
certified client initiating the bid;
Figure 22 depicts a detail flowchart of operation 5592 of Figure 21A for operating the equipment usage item;
Figure 23A depicts a detail flowchart of operation 5042 of Figure 4 for managing the market position portfolio;
Figure 23B depicts a detail flowchart of operation 5732 of Figure 23A for io presenting the local market position portfolio;
Figure 24 depicts a detail flowchart of operation 5752 of Figure 23B for presenting the market position summary;
Figure 25A depicts a detail flowchart of operation 5000 of Figure 4 for the
method of using the transaction system;
i5 Figure 25B depicts a detail flowchart of operation 5832 of Figure 25A for
maintaining the market position database;
Figure 26 depicts a detail flowchart of operation 5852 of Figure 25B for maintaining the market position;
Figure 27A depicts a detail flowchart of operation 5042 of Figure 4 for maintaining the local market position portfolio;
Figure 27B depicts a detail flowchart of operation 5000 of Figure 2A-2E for
the method of using the transaction system;
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Figure 28A depicts a detail flowchart of operation 5000 of Figure 2A"2E for
the method of using the transaction system;
Figure 28B depicts a detail flowchart of operation 5872 of Figure 26 for maintaining the current bid list;

Figure 29 depicts a detail flowchart of operation 5032 of Figure 4 for managing the bilateral trading portfolio;
Figure 30A depicts a detail flowchart of operation 5032 of Figure 4 for managing the bilateral trading portfolio;
Figure 30B depicts a detail flowchart of operation 5062 of Figure 4 for io managing the credit resource collection, for each of the credit resources of the
credit resource collection;
Figure 31 depicts a detail flowchart of operation 8152 of Figure 30B for managing the credit resource, for at least one of the credit resources of the
credit resource collection;
Figure 32A depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource;
Figure 32B depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource;
Figure 33A depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource;
Figure 33B depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource;
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Figure 34A depicts a detail flowchart of operation 5052 of Figure 4 for managing said market trade collection; and
Figure 34B depicts a detail flowchart of operation 8412 of Figure 34A for presenting said market trade, for at least one of said market trades.

Detailed Description of the Invention
Note that a commitment may be performed without requiring a schedule. For example, a first certified client may buy a certain amount of green tickets, e.g.

a form of tradable ecology-based energy credit, from a second certified client.

In such situations, there might be no schedule generated for that commitment,
io but each certified client involved in the commitment would find the commitment referenced in the settlement.

A commitment may be scheduled for performance, but. not actually be performed. For example, a network operator may curtail the availability of electrical power to consumers in certain areas to avert a blackout. Those i5 consumers, while having scheduled commitments, did not fully enjoy the
performance of the commitments. While the schedule would reflect the commitment, the settlements for those consumers would reference the actual perf ormance of that commitment.

Figure 2A depicts various certified clients, 3100, 3120, 3140, and 3160-3180, controlling a means for using 5000 a transaction system 6000.

The certified client may control 3102, 3122, 3142 and 3182 the means of use 5000 acoustically and/or tactilely and/or via wireless communications and/or via wireline communications the transaction system 6000.

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Means for using 5000 and/or transaction system 6000 may include implementations of the respective operational methods, which do not rely upon instruction pointers and as such may not be considered as computers in a traditional sense.

Note that these entities, the human being 3100, corporate entity 3120, agent
3140 and software agent 3160 may communicate with means 5000 by use of messages as represented by arrows 3102, 3122, 3142, and 3182, respectively. Such messages may use a wireline physical transport layer as represented by one or more of the arrows 3102, 3122@ 3142, and 3182. Such lo messages may use a wireless physical transport layer as represented by one
or more of,the arrows 3102, 3122, 3142, and 3182. Such messages may use body signals in certain further embodiments of the invention. Such messages
may further use hand signals. Such message may also use acoustic signaling of messages. Such messages may also further use verbal messages in a human language.

Figure 2B depicts a simplified block diagram in which the mean 5000 for using
means supporting transaction system 6000 includes a transaction system 3000 comprised of at least one computer communicatively coupled with the certified client(s) and controlled by program system(s) made up of program steps residing in accessibly coupled 3022 memory 3026.

The operational methods 5000 and 6000 are respectively supported by program systems 5000 and 6000 contai ning program steps residing in memory 3026 accessibly coupled 3022 to at least one computer 3020 in the transaction system.

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The transaction system may further comprise a client computer communicatively coupled to a server computer included in a server system.

The certified client may operate the client computer to interactively use the transaction system.

The server system may provide a market engine supporting a virtual trading
floor involving at least one of the fungible, ephemeral commodities. The server system may further comprise an engine system supporting the virtual trading floor involving the fungible, ephemeral commodities.

Transaction system 3000 is comprised of at least one computer 3020 coupled
io 3024 to computer readable memory 3026. The communication and interaction between transaction system 3000 and computer 3020 is denoted by arrow 3022. Such communication and interaction 3022 may employ a variety of communications technologies, including a wireless physical transport layer in certain embodiments of the invention. Alternatively, communication and interaction 3022 may employ a wireline physical transport layer.

Note that the,, invention may include only a market engine of the invention supporting at least any two of the following: a virtual trading floor 6032, bilateral trading 6042 and/or external market trading 6052, as well as maintain the commitment list 6062.

Figure 2C depicts a refinement of transaction system 3000 as a system diagram in Figure 2B. This transaction system is comprised of a client computer collection and a server system 3500 coupled to a network 3200.

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The client computer collection is comprised of at least one client computer
3600 operated (used) 3192 by certified client 1400. Client computer 3610 may be operated (used) 3104 by a human being as client 3100. Client computer 3620 may be operated (used) 3124 by a corporate entity as client 3120. Client computer 3630 may be operated (used) 3144 by an authorized agent as client 3140. The certified client may be represented by an agent, authorized by the first party, to act on behalf of the first party with respect to **contracting** .
Server system 3500 includes at least one server computer 3520 coupled to io network 3200. Network 3200 further couples 3602, 3612, 3622@ 3632 and 3642 to client computers 3600, 3610, 36207 3630 and 3640, respectively.

Network 3200 at least supports communication between client computers and at least one server computer 3520 of server system 3500. As used herein, .the term network refers not only to Local Area Networks (LANs), but also to
Wide Area Networks (WANs). Network supported communication as used herein includes, but is not limited to, digital communication protocols as well
as analog communication protocols. Network supported communication as used herein further includes, but is not limited to, message passing protocols
and packet based protocols. Network supported communication as used
2o herein further includes, but is not limited to, communication protocols
including TCP/IR Network supported communication as used herein further includes, but is not limited to, communication protocols supporting the Internet. Network supported communication as used herein further includes,
but is not limited to, communication protocols supporting the World Wide Web.

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Client computer 3610 with coupled 3614 computer readable memory 3616 may be operated 3104 by a client 1400 further coupled 3194 to computer readable memory 3606. Memory 3616 is shown containing program system 5000 and program system 4000. Program system 4000 implements a method of operating the client computer with respect to the transaction system, including the server and/or server system as illustrated in Figures 2C to 2E.

Due to,space constraints in Figures 2C to 2E, program system 4000 is only explicitly shown here. This is not means to limit the scope of the Claims, but is done strictly for the purpose of clarifying the discussion and drawings.

lo Client computer 3640 with coupled 3644 computer readable memory 3646 may be operated 3164 by a software agent as client 3160. The coupling 3194 may provide various personal optimizations and shortcuts, including, but not limited to, macro style functions and standard **contract** forms employed by the client 1400.
Server system 3500 may include at least one server computer 3520 coupled 3524 to computer readable memory 3526.

Figure 2D depicts a refinement of transaction system 3000 as a system diagram in Figure 2C. This transaction system is comprised of a client computer collection and a server system 3500 coupled to a network 3200.

Server system 3500 may include at least one server computer 3520 coupled 3524 to computer readable memory 3526.

Note that server computer coupled computer readable memory may contain a read-write accessible memory. Note that the read-write accessible memory ma y contain at least one mass storage unit. In certain a mass storage unit
,30
may include a disk drive. A mass storage unit may be accessed using a file management system. A mass storage unit may be accessed as a database.

The invention also comprises a method of operating a client computer with a client computer message address interfaced with a reliable distributed system
composed of a server system containing server computers with associated messaging addresses. The method includes a login procedure, a message composition procedure for an outgoing message to the reliable distributed system, and a message analysis procedure for an incoming message from the reliable distributed system.

io The login procedure may maintain a list of messaging addresses of the collection of computers of the distributed system, a first login message and a login protocol and performs the following.

a. A first server computer of the server system is selected, and a first login message is sent to the associated address of the first server computer.

b. If there is a first acknowledgment message received'frorn the first server computer message address then the login procedure proceeds to perform the login protocol.

C. Whenever the login protocol fails with the first server computer or o whenever there is no acknowledgment message received from the first server computer within a predetermined amount of time or
whenever there remain server computers in the server.systern for which login has not been attempted,
a new first server computer is selected from the remaining server computers of the server system and these steps are repeated.

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d. Whenever the login protocol succeeds with the first server computer, the first server computer is designated the connection computer.

The message composition procedure for an outgoing message to the distributed system may comprise performing the following: Maintaining a list of message formats. Determining the selection of a first message format. Using
the first message format to create an outbound message. Sending the outbound message to the connection computer.

The message analysis procedure for an incoming message from the distributed system may comprise performing the following: Receiving the io message from the connection computer. Validating the received message creates a valid received message.

An object class structure may be used to support message passing, each message comprising a message type and at least one message field. Each message-passing object comprises handling an unknown message type and

handling for an unknown message.field.

Handling an unknown message type for a received message from a first object by a second object may comprise the first object sending the second
object a reply message indicating unknown received message type and referencing the received message.

Handling an unknown message field of the received message by the second object may comprise handling the other fields of the received message by the second object.

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The invention may operate a reliable distributed system of a collection containing at least one process group running on several computers comprising receiving confirmed messages from certified clients and maintaining a group state. Each process group computer possesses a messaging address. The computers of a process group communicate among themselves with a virtually synchronous messaging system.

Receiving a confirmed message from a certified client may occur at one computer of the first collection of computers running the process group. Upon
receipt the receiving computer broadcasts the confirmed message from the io certified client to all computers of the first collection of computers.

Maintaining a group state on each computer of the first collection of computers of the process group may comprise the following operations: Each computer processes the confirmed message from the certified client to create a group state candidate. Each computer broadcasts a virtually synchronous
group state candidate message to the other computers. Each computer receives the virtually synchronous group state candidate messages of the other computers. Each computer analyzes the received virtually synchronous
group state candidate messages and its own virtually synchronous group state candidate to create a new group state.

2o Reliable distributed computer systems have been developed in the prior art, as in Reliable Distributed Computing With the Isis Toolkit, edited by Birman
and Van Renesse, ISBN 0 5342-'6v @ 1994 Institute for Electrical and Electronic Engineers, Inc. These reliable distributed systems are based around process groups of cooperating concurrent processes redundantly
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performing the same operations on copies of the same data while being distributed through a multi-computer system.

The prior art (particularly in Chapter 1 1 , "Reliable Communication in the Presence of Failures" pages 176-200, in Reliable Distributed Computing With
the Isis Toolkit discloses basic communication protocols, ABCAST and GBCAST, for broadcasting messages within a process group and for detecting and reacting to network failures. The protocols provide strong guarantees for message delivery causality and message delivery atomicity.

Message delivery causality is the guarantee that a 'message should not be io delivered before its predecessor. Message delivery atomicity guarantees that two messages are delivered in the same sequence to all

recipients.

The invention may employ a messaging system for message passing concurrent objects, instances of which reside on computers each possessing
a controller belonging to a collection of computers comprising ABCAST protocol and GBCAST protocol. The ABCAST protocol is an atomic broadcast protocol used to communicate messages between object instances across the computers of the collection of computers. The GBCAST protocol is a global broadcast protocol to communicate messages between controllers of the computers of the collection of computers.

The invention may employ an object class structure executing in a process group of computers communicating with each other via a messaging protocol supporting at least virtual synchrony. Each instance of each object of the object class structure comprises an object instance clone reading on each of the process group computers.

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Each object instance may further send and receive messages from other object instances and each object instance clone communicates with messages to other object instance clones of the same object instance.

However, the ABCAST and GBCAST protocols are not sufficient by themselves to implement a message driven architecture. A message driven architecture requires that objects can not only send message to each other, but also reply to those messages. The R-Object class, as used herein, refers
to an object class supporting at least ABCAST, GBCAST and a message driven architecture.

io Each object class may further possess a state, which is a member of a collection of states. Each instance of each object class state changes as an atomic event. All activities of each object class occur as atomic events.

Atomic events may be triggered by message reception. Each instance of an object receives messages triggering state changes in the same sequence as all other instances of that object. This enforces all R-Object instances changing their state through exactly the same sequence without having to directly communicate that new state among themselves.

A concurrent computing entity may reside on each of the computers of a process group of computers where it owns access to a binary file or memory used for storing the resilient object instance state. It executes updates to the binary file as a transaction. The storage in the binary file is organized into table objects. Each table object consists of a set of records.
in certain embodiments of the invention, all individuals wishing to access the RTO systems must establish a login session with the appropriate system.

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This applies to RTO participants, RTO staff, as well as other systems that are integrated into the platform. Each login session is established under the protocols of the security integrated into the RTO systems. The location of the
session may not be important to the system, allowing the RTO to operate multiple sites. The multiple RTO sites may each operate as a monitor site, a failover site, or to share workload. Login session at multiple

sites can be
connected to server system 3500 simultaneously, and are synchronized by server system 3500.

Each RTO participant may share the same security information for authorized io scheduling entities (ASEs), RTO operators, and transmission operators (TOs).

This security information may be maintained through the registration interface, through which all permissions for each participant may be maintained. This information may be used to validate all login sessions.

Access to the server system 3500 and/or server computer 3560 may be obtained by establishing a login session with the appropriate system. This may apply to RTO participants, including ASEs, RTO operators, and TOs, as
well as other computer systems,. such as EMS/SCADA systems. This ensures that only authorized individuals and systems can access the APX systems.

2o The security information may be checked each time that an RTO participant
or computer system attempts to log into server system 3500 or server computer 3520 or web server 3560. Login information may include a login ID
and password. Login information may be passed in an encrypted form. If access is permitted, the login session may then be configured in accordance with the permissions associated with the particular login ID.

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This ensures that each RTO participant may access only those systems and data to which the participant is authorized.
Access to each system may also be controlled in terms of modes including at least receiving data, placing bids, and viewing positions. This mechanism restricts each login session to its authorized systems, making available only its authorized information, and does so in only its authorized modes.

Each login session may include a real-time, two-way communication session or a secure web-based connection between the RTO participant software and the servers. Each session may rely on one or more encryption mechanisms lo to encode the communication. For the real-time connections, this mechanism may include frequent encryption key change, which may further be invisible to
the user to ensure privacy of communication between each RTO participant and the systems 3500 and 3560.

The invention may include help desk staff. The help desk staff may not have access to market data, scheduling data, or any participant business data.

Further, the help desk staff may be unable observe A/S auction or EIS market
activity. The help desk staff may not know who or what was selected or dispatched, or at what price. The help desk staff may in certain embodiments only monitor system conditions, such as the number of sessions logged on, the level of activity in the market (for performance monitoring), and when bidding is opened or closed. The help desk staff may maintain reliable data archives and backups on all servers. The help desk staff may. perform these maintenance and archival tasks without

regard to content.

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In certain embodiments, certified users are primarily approved scheduling entities (ASEs), the control area operators (CAOs), and the RTO operators (regardless of location). These certified users may participate in the RTO at the operational level, using services of the server system 3500 or web server 3560.

The invention may include a method of, operating a client computer communicatively coupled to an engine system. The engine system includes at
least one of the following: a market engine, a scheduling engine and a settlement engine. The client computer communicating with the engine
lo system supports certified client transactions regarding market intervals. Each
market interval contains at least one fungible, ephemeral commodity, a location and a time interval.

An engine group includes at least two engine group computers, each implementing a market engine, a scheduling engine or a settlement engine.

Note that two engine group computers may redundantly implement a market engine. Alternatively, two engine group computers may redundantly implement a scheduling engine. Additionally, two engine group computers may redundantly implement a settlement engine. An engine group may include two engine group computers implementing different engines. The
2o engine group provides multiple access mechanisms by which communications between the client computer and the engine system may take place.

Note that the engine system may include one or more engine groups. Note that the engine system may be implemented as an engine group.

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The client computer may interact with at least one member of the engine group by establishing the client computer as the certified client through communication with the engine system and participating as the certified client communicating with the engine system.

The engine group advantageously removes the potential for a single point of failure in the communication between the client and the engines implemented by the engine group, increasing the overall communication system reliability.

Figure 2E depicts a grid management system providing functions and services for grid market operations including a collection of client computers lo 3700; 37207 3740@ 3760 and 3780 respectively coupled through network 3200
to server system 3500 including server computer 3520, and web server computer 3560, as well as server computer 3580 and database engine 3590.

The. discussion of variations regarding the use of client computers is found in Figures 2C and 2D1. A certified client, possibly a human being, corporate entity, agent, or software agent may each control any of the examples of client computers 3700, 3720@ 37402 3760 and 3780.

As used herein, MOPI refers to Market Operations Participant Interface.

MOPI is an interface may that include, but is not limited to, the

functions and capabilities of Participantsi who are certified clients of the system.

As used herein, RTOI refers to RTO Operator Interface. RTOI is an interface that may include, but is not limited to, the functions and capabilities of Participants, who are certified clients of the system and who interact as RTO Operators within one or more grids.

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As used herein, EMS refers to Energy Management System.

EMS and RTOI components may each further perform operations including, but not limited to,
Receiving energy management schedules,
e Confirming receipt of energy management schedules,
Receiving requests for energy equipment status,
Providing energy equipment status,
0 Sending requests for energy equipment status,
0 Receiving energy equipment status reports,
io 9 Receiving metering data about transmission lines,
0 Receiving frequency data about transmission lines, and
0 Command override messages putting a specific remote energy site off limits to automated control and places it under manual control of the operator.

i5 * Sending output adjustment commands to remote energy generation sites.

Note that these output adjustment commands have the effect of modifying the transmission line frequencies and the output adjustment commands take into
account the effect on transmission line frequencies as well as flowgate constraints in making these commands.

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There may be client computers with accessible memory containing MOPI components such as client computers 3700 and 3720 or containing RTOl components such as client computers 3740 and 3760 or containing EMS components such as client computer 3780. There may be no client computers with accessible memory containing MOPI components such as client computers 3700 and 3720. There may be no client computers with accessible memory containing RTOl components such as client computers 3740 and 3760. There may be no client computers with accessible memory containing EMS components such as client computer 3780.
Client computer 3700 accessibly couples 3704 to computer readable memory 3706 as well as communicatively couples 3702 to network 3200. The MOPI realtime component 3710 and MOPI dynamic and static component 3712 may both reside in accessibly coupled memory 3706.

The MOPI realtime component 3710 may include a method of using market engine 3810 with MOPI dynamic and static component 3712. The method of using market engine 3810 may include, but is not limited to,
participating in sessions with market engine 3810 in which at least one of the following may
occur. An order may be sent, which may include one or more ask orders and/or one or more bid orders. A market price may be requested. A market price may be received. A validated commitment may be received. Notification of the opening or closing of a market interval may be received.

The MOPI realtime component 3710 may include the ability to use communication with more than one server computer 3520 within server system 3500 to communicate within a session with the market engine 381 0.

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The MOM realtime component 3710 may include the ability to encrypt the communication with server system 3500. Alternatively, the client computer 3700 may include security devices insuring security independently of the method of using the market engine. Additionally both the MOM realtime component 3710 and the client computer 3700 may act together to provide two layers of security.

Client computer 3720 accessibly couples 3724 to computer readable memory 3726 as well as communicatively couples 3722 to network 3200. The MOM software component 3730 and MOM dynamic and static component 3732 io may both reside in accessibly coupled memory 3726.

The MOM realtime component 3730 may include a method of using market engine 3810 with MOM dynamic and static component 3712. The method of using market engine 3810 may include, but is not limited to, participating in sessions with market engine 3810 in which at least one of the following may
occur. An order may be sent, which may include one or more ask orders and/or one or more bid orders. A market price may be requested. A market price may be received. A validated commitment may be received. Notification of the opening or closing of a market interval may be received.
The MOM realtime component 3730 may include the ability to use communication with more than one server computer 3520 within server system 3500 to communicate within a session with the market engine 3810.

MOPI realtime component 3730 may further include API 3734, which controls the ability to use communication with more than one server computer 3520 within server system 3500 to communicate within a session with the market engine 381 0.

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The MOM realtime component 3730 may include the ability to encrypt the communication with server system 3500. Alternatively, the client computer 3720 may include security devices insuring security independently of the method of using the market engine. Additionally both the MOPI realtime component 3730 and the client computer 3720 may act together to provide two layers of security. MOM realtime component 3730 may include security module 3736 providing the ability to encrypt the communication with server system 3500.

Client computer 3740 accessibly couples 3744 to computer readable memory io 3746 as well as communicatively couples 3742 to network 3200. The RTOI software component 3750 and RTOI dynamic and static component 3752 may both reside in accessibly coupled memory 3746.

The RTOI realtime component 3750 may include a method of using market engine 3810 with RTOI dynamic and static component 3712. The method of using market engine 3810 may include, but is not limited to, participating in sessions with market engine 3810 in which at least one of the followi.ng may
occur. An order may be sent, which may include one or more ask orders and/or one or more bid orders. A market price may be requested. A market price may be received. A validated commitment may be received. Notification of the opening or closing of a market interval may be

received.

The RTOI realtime component 3750 may include the ability to use communication with more than one server computer 3520 within server system 3500 to communicate within a session with the market engine 3810.

RTOI realtime component 3750 may further include API 3754, which controls the ability to use communication with more than one server computer 3520
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within server system 3500 to communicate within a session with the market engine 3810.
The RTOI realtime component 3750 may include the ability to encrypt the communication with server system 3500. Alternatively, the client computer 3740 may include security devices insuring security independently of the method of using the market engine. Additionally both the RTOl realtime component 3750 and the client computer 3740 may act together to provide two layers of security. RTOl roaltime component 3750 may include security module 3756 providing the ability to encrypt the communication with server io system 3500.

Client computer 3760 accessibly couples 3764 to computer readable memory 3766 as well as communicatively couples 3762 to network 3200. The RTOI software component 3770 and RTOI dynamic and static component 3772 may both reside in accessibly coupled memory 3766.

15@ Th e RTOI realtime component 3770 may include a method of using market
engine 3810 with RTOl dynamic and static component 3712. The method of using market engine 3810 may include, but is not limited to, participating in sessions with market engine 3810 in which at least one of the following may
occur. An order may be sent, which may include one or more ask orders 2o and/or one or more bid orders. A market price may be requested. A market price may be received. A validated commitment may be received. Notification of the opening or closing of a market interval may be received.

The RTOI realtime component 3770 may include the ability to use communication with more than one server computer 3520 within server
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system 3500 to communicate within a session with the market engine 3810.

RTOl realtime component 3770 may further include API 3774,.which controls the ability to use communication with more than one server computer 3520 within server system 3500 to communicate within a session with the market engine 3810.

The RTOI realtime component 3770 may include the ability to encrypt the communication with server system 3500.. Alternatively, the client computer
3760 may include security devices insuring security independently of the method of using the market engine. Additionally both the RTOl realtime lo component 3770 and the client computer 3760 may act together to provide two layers of security. RTOl realtime component 3770 -may include security module 3776 providing the ability to encrypt the communication with server system 3500.

Client computer 3780 accessibly couples 3784 to computer readable memory 3786 as well as communicatively couples 3782 to network 3200. The EMS realtime component 3790 may both reside in accessibly coupled memory

3706.

The EMS realtime component 3790 may include a method of using market -engine 3810 with EMS dynamic and static component 3712. The method of using market engine 381 0 may include, but is not limited to, participating in sessions with market engine 3810 in which at least one of the following may occur. An order may be sent, which may include one or more ask orders and/or one or more bid orders. A market price may be requested. A market price may be received. A validated commitment may be received. Notification of the opening or closing of a market interval may be received.

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The EMS realtime component 3790 may include the ability to use communication with more than one server computer 3520 within server system 3500 to communicate within a session with the market engine 3810. EMS realtime component 3790 may further include API 3794, which controls the ability to use communication with more than one server computer 3520 within server system 3500 to communicate within a session with the market engine 381 0.

The EMS realtime component 3790 may include the ability to encrypt the communication with server system 3500. Alternatively, the client computer 3780 may include security devices insuring security independently of the method of using the market engine. Additionally both the EMS realtime component 3790 and the client computer 3780 may act together to provide two layers of security. EMS realtime component 3790 may include security module 3796 providing the ability to encrypt the communication with server system 3500.

Because many components are integrated into the architecture, they are available to all operational functions. The RTOI software component 3750 and RTOl dynamic and static component 3752, for example, may share the common communications and communicate directly with the RTO participants 2o and RTO staff simultaneously. This permits the creation of integrated user interfaces that contain all of the functions of the services delivered via these systems in a single point of contact. The users are not forced to deal with integration issues and disparate mechanisms to communicate with the RTO.

In certain embodiments of the invention, all individuals wishing to access the RTO systems must establish a login session with the appropriate system.

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This applies to RTO participants, RTO staff, as well as other systems that are integrated to the platform. Each login session is established under the protocols of the security integrated into the RTO systems. The location of the session may not be important to the system, allowing the RTO to operate multiple sites. The multiple RTO sites may each operate as a monitor site, a failover site, or to share workload. Login session at multiple sites can be connected to server system 3500 simultaneously, and are synchronized by server system 3500.

Each RTb participant may share the same security information for authorized lo scheduling entities (ASEs), RTO operators, and transmission

operators (TOs).
This security information may be maintained through the registration interface, through which all permissions for each participant may be maintained. This information may be used to validate all login sessions.

Access to the server system 3500 and/or server computer 3560 may be obtained by establishing a login session with the appropriate system. This may apply to RTO participants, including ASEs, RTO operators, and TOs, as
well as other computer systems, such as EMS/SCADA systems. This ensures that only authorized individuals and systems can access the APX systems.

2o The security information may be checked each time that an RTO participant
or computer system attempts to log into server system 3500 or server computer 3520 or web server 3560. Login information may include a login ID
and password. Login information may be passed in an encrypted form. If access is permitted, the login session may then be configured in accordance with the permissions associated with the particular login ID.

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This ensures that each RTO participant may access only those systems and data to which the participant is authorized.

Access to each system may also be controlled in terms of modes including at least receiving data, placing bids, and viewing positions. This mechanism restricts each login session to its authorized systems, makes available only its authorized information, and does so in only its authorized modes.

Each login session may include a real-time, two-way communication session or a secure web-based connection between the RTO participant software and the servers. Each session may rely on one or more encryption mechanisms lo to encode the communication. For the real-time connections, this mechanism may include frequent encryption key change, which may further be invisible to
the user to ensure privacy of communication between each RTO participant and the systems 3500 and 3560.

Certain embodiments may include help desk staff. The help desk staff may i5 not have access to market data, scheduling data, or any participant business data. Further, the help desk staff may be unable observe A/S auction or EIS market activity. The help desk staff may not know who or what was selected
or dispatched, or at what price. The help desk staff may in certain embodiments only monitor system conditions, such as the number of sessions logged on, the level of activity in the market (for performance monitoring), and when bidding is opened or closed. The help desk staff may maintain reliable data archives and backups on all servers. The help desk staff may perform these maintenance and archival tasks without regard to content.

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In certain embodiments, certified users are primarily approved scheduling entities (ASEs), the control area operators (CAOs), and the RTO operators (regardless of location). These certified users may participate in the RTO at the operational level, using services of the server system 3500 or web server 3560.

The invention also comprises a method of operating a client computer communicatively coupled to an engine system. The engine system includes at
least one of the following: a market engine, a scheduling engine and a settlement engine. The client computer communicating with the engine io system supports certified client transactions regarding market intervals. Each
market interval contains at least one fungible, ephemeral commodity, a location and a time interval.

An engine group. includes at least two engine group computers, each implementing a market engine, a scheduling engine or a settlement engine.

is Note that two engine group computers may redundantly implement a market
engine. Alternatively, two engine group computers may redundantly implement a scheduling engine. Additionally, two engine group computers may redundantly implement a settlement engine. An engine group may include two engine group computers implementing different engines. The engine group provides multiple access mechanisms by which communications between the client computer and the engine system may take place.

Note that the engine system may include one or more engine groups. Note that the engine system may be implemented as an engine group.

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The client computer may interact with at least one member of the engine group by establishing the client computer as the certified client through communication with the engine system and participating as the certified client communicating with the engine system.

The engine group advantageously removes the potential for a single point of failure in the communication between the client and the engines implemented by the engine group, increasing the overall communication system reliability.

Figure 2E depicts a collection of client computers 3700, 3720@ 3740, 3760 and 3780 respectively coupled through network 3200, as depicted in Figure 2E,
io with further refinements showing a program system 4000 supporting communicating with one or more members of the engine system, as well as encryption devices.

Program system 4000 contains program steps residing in the accessibly coupled memory of the client computers, implementing the method of operating the client computers in their communicative interactions with one or more of the engines or the engine group shown in Figure 2E. Note that any client computer may accessibly coupled to more than one kind of memory.
The discussion herein refers to accessibly coupled memory as including any memory, which can even once be accessibly coupled to the client computer.

The MOM realtime component 3710 may include the program system 4000, or be included within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one or more of the engines or the engine group shown in Figure 2E.

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Client computer 3700 may interact with at least one member of the engine group by establishing the client computer as the certified client through communication with the engine system and participating as the certified client communicating with the engine system.

The MOPI realtime component 3730 may include the program system 4000, or be included within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one or more of the engines or the engine group shown in Figure 2E.

API component 3734 may include the program system 4000, or be included lo within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one or more of the engines or the engine group shown in Figure 2E.

Security module 3736 may be included in program system 4000.
Alternatively,
security module 3736 may be used through a software interface by program system 4000. Security module 3736 may include a third party vendor supplied software component. Security module 3736 may include an implementation of the Secure Socket Layer protocol.

Client computer 3720 may include security device 3800 insuring security independently of the method of using the market engine or the software controlling client computer 3720. Additionally both the MOPI realtime component 3730 and the client computer 3720 may act together to provide two layers of security. MOPI realtime component 3730 may include security module 3736 providing the ability to encrypt the communication with server system 3500.

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Client computer 3720 may be coupled 3802 to encryption device 3800. Client computer 3720 may control the operation of encryption device 3800. The RTOI software component 3750 may include the program system 4000, or be included within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one or more of the engines or the engine group shown in Figure 2E.

API component 3754 may include the program system 4000, or be included within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one or more of lo the engines or the engine group shown in Figure 2E.

Security module 3756 may be included in program system 4000.
Alternatively,
security module 3756 may be used through a software interface by program system 4000. Security module 3756 may include a third party vendor supplied software component. Security module 3756 may include an implementation of the Secure Socket Layer protocol.

Encryption receiver 3810 may receive 3812 messages from one or more of the engine group from network 3200. The results of processing the received message may be conveyed 3814 to client computer 3740.

Encryption transmitter 3820 may receive 3822 messages from client computer 2o 3740 to be encrypted. The encrypted messages may then be sent 3824 from encryption transmitter 3820 to network 3200.

In certain embodiments of the invention, a single security device may incorporate encryption receiver 381 0 and encryption transmitter 3740.

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Encryption receiver 3810 may receive 3812 messages from and encryption transmitter 3820 may transmit 3824 messages to the same engine of the engine system. Encryption receiver 3810 may receive 3812 messages from and encryption transmitter 3820 may transmit 3824 messages to different engines of the engine system.

The RTOI realtime component 3770 may include the program system 4000, or be included within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one
or more of the engines or the engine group shown in Figure 2E,
lo API component 3774 may include the program system 4000, or be included within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one or more of the engines or the engine group shown in Figure 2E.
Security module 3776 may be included in program system 4000.
Alternatively,
security module 3776 may be used through a software interface by program system 4000. Security module 3776 may include a third party vendor supplied software component. Security module 3776 may include an implementation of the Secure Socket Layer protocol.

The EMS realtime component 3790 may include the program system 4000, or 2o be included within the program system 4000 as the implementation of the method of operating the client computer to communicatively interact with one or more of the engines or the engine group shown in Figure 2E.

API component 3792 may include the program system 4000, or be included within the program system 4000 as the implementation of the method of
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operating the client computer to communicatively interact with one or more of the engines or the engine group shown in Figure 2E.

Client computer 3700 may include encryption device 3830 insuring security independently of the method of using the market engine. Both the EMS realtime component 3790 and client computer 3700 may act together to provide two layers of security. EMS realtime component 3790 may include security module 3796 providing the ability to encrypt the communication with server system 3500.

Communication 3832 between client computer 3780 and encryption device lo 3830 may utilize memory access mechanism 3784. The memory access mechanism 3784 may be across a general-purpose bus. Communication 3832 may act as an input-output port scheme on the general-purpose bus.

Communication 3832 may also be implemented by use of a memory-mapping scheme whereby encryption device 3830 is accessed 3784 by special addresses 3832 in the memory domain.

Note that a client computer system may employ more than one security, device. Further, a client computer system may employ different security measures in communication with different engines of the engine system.

Figure 3A depicts a virtual trading floor 1000, containing validated orders and
market intervals with associated market states and further containing a certified client collection of certified clients.

The virtual trading floor mechanism 1000 comprises a collection of market intervals, each with an associated market state, and validated orders. A
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market contains a product type and a location. Trading in the market is done
in terms of market intervals 1100, 1120, and 1140 as well as specialized market intervals including transfer intervals 1160 and macro market intervals 11200@ 1210 and 1220.

Each market interval of a market contains the market product type, market location, plus a calendar scheme with an interval end. The market state of a market interval comprises a market price for the market interval product type at the market interval location during the market interval time interval.

Note that some market intervals such as market interval 1 1 60 are further io denoted as transfer intervals, further shown in Figure 3D. A transfer interval I 1 60 includes a location further distinguished as having a start location 1 1 63 and a delivery location 1164. For many fungible non-ephemeral commodities, not only is a product type 1161 specified, but also a transfer type 1162 is
specified. By way of example, a container of wheat may be transported by truck, train, barge or ship. As with other market intervals, there is a time interval 1165 involved, which designated the expected time of transport.

Macro market intervals 1200, 1210, and 1220 are also shown. These are specialized market intervals which reflect at least one origin market interval
and at least one destination market interval. Figure 3E provides a more 2o detailed discussion of macro markets for fungible non-ephemeral commodities. Figure 3F provides a more detailed discussion of macro markets for fungible ephemeral commodities.

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A validated order may contain an amount of the market interval product type, a price for the market interval product type. The validated order is either a bid validated order or an ask validated order.

Figure 3A also depicts a certified client collection comprised of certified clients. Certified clients may include, but are not limited to, human beings.

Certified clients may further include, but are not limited to, corporate entities.
Certified clients may also further include agents authorized by the certified clients to represent them in interactions regarding the virtual trading floor.

Certified clients may also further include software agents executing on io software agent computers authorized by certified clients to represent them in
interactions regarding the virtual trading floor. Note that in certain embodiments of the invention, the market engine manages and/or maintains the certified client collection.

A virtual trading floof may support trading ephemeral, fungible commodities of an electrical power grid containing at least one AC power network. Each AC power network further contains a node collection of at least two nodes. The product type of thd market intervals oi the market

interval collection may be a
member of a product type collection comprised of energy and AC **power transfer** . The location of a market interval having an energy product type may 2o be a first node of the node collection of an AC power network contained in the electrical power grid. The location of a market interval having an AC **power transfer** product type may be from a first node of a first AC power network contained in the electrical power grid to a second node of the first AC power network.

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Some certified clients may be market makers 1440. Market makers are market participants who have taken on the additional role of attempting to arbitrage in transmission.

For fungible ephemeral commodities, market makers 1440 use the transaction system to access point-to-point transmission orders and individual flowgate orders. Market makers 1440 may also have their own inventories of point-to
point transmission rights and flowgate rights, which they may or may not choose to post in the market.

Market makers 1440 may also be described as market providers in certain lo economic systems, where the term "market maker" has a pro-established and divergent meaning.

Market makers 1440 may receive "request for quotes" from other certified clients. In energy markets, these requests may be triggered whenever a participant opens an Energy Market screen for a particular facility, market, strip, and lot size. Using mathematical models of their own choosing, market makers may generate quotes for the transmission products displayed on the
participant's screen. These quotes may be submitted to the transaction system as market maker quotes.

The transaction system may identify market maker quotes, and may keep them separate from the standing orders submitted by participants who actually own, or wish to buy, transmission. The reason is that the market maker quotes are derived from the standing orders, and market makers will not want to consider these derived quotes when creating new derived quotes.

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If they did, the number of possibilities for them to consider would explode, with no gain in information.

Market makers may interactively submit their quotes to the transaction system. Speed in calculating quotes would be of the essence, since the only real risk to the market maker is posting a quote based on stale data.

Market makers may withdraw their quotes at any time, even after the participant has signaled his/her acceptance and it is on the way back through
the network to the market maker. Market makers may not, however, refuse an order that is based on a quote that is still posted at the time they receive lo that order. Not having this rule would open the way for all kinds of gaming by
market makers, which would undermine the integrity of the market. Like market makers everywhere, market makers in this system must be constantly reevaluating and updating their quotes.

A single market could have multiple competing market makers. Market makers may compete for competitive advantage based on the speed of their responses (thereby minimizing losses due to stale quotes), the ability of their algorithms to find the best price, their skill at maintaining strategic inventories of flowgates and point-to-point transmission rights, and their operating costs.

This kind of competition encourages innovation, low costs, and liquidity, and is good for the participants.

Market makers may be allowed to go into a negative position in individual flowgate rights, or even point-to-point rights, assuming they have sufficient credit with the RTO. If the market maker is still in a negative position at the scheduling deadline, he/she will be billed for the missing transmission rights,
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just as if they had submitted an uncovered schedule. To the participant who bought the transmission right from a market maker with a negative position,
the transmission right is the same as any other. This rule provides a 99 cushion" that insures liquidity in the market. It means that market makers always have a way to quote a price for any transmission the participants may desire to buy or sell. The rule is harmless, in such embodiments, all of these transmission rights affect only the financial settlement.

Allowing market makers to go into negative positions in transmission rights also removes any incentive to hoard transmission rights. Without this rule, hoarding could be attractive in a system with hundreds of flowgates, since one participant could buy up all the rights to some flowgate that is not perceived as scarce for very little money. Without a liquid market in even one flowgate, it might be impossible for market makers to create quotes for many point-topoint rights.
There may be rules prohibiting a single participant from owning more than a certain fraction of a single flowgate. But such rules require policing and can get in the way of some participants with legitimate needs, and might not be effective if several participants act in concert (with or without explicit collusion).

The RTO's role may begin with the initial auctions. The RTO auctions both flowgate rights and point-to-point rights, based on an algorithm that maximizes the value received. This algorithm is similar to the algorithm currently used by PJM to auction FTRs.

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Thus, once a new transmission provider is acknowledged by the RTO, it Linder normal conditions, the RTO stands behind all point-to-point rights, both those auctioned initially and those created (and recreated) by market makers and participants. Any participant can obtain reasonable price certainty by buying a point-to-point right. In the event that one of the 400 flowgates has to
be de-rated, the RTO may buy back the flowgate rights.or optionally redispatch around the problem.

lo In the event that a new constraint appears in the system that is not one of the traded flowgates, the RTO may buy back existing flowgate rights in order to force flows to meet the new constraint, or optionally redispatch around the
problem. No new flowgates are ever added after the initial auction. With

hundreds of degrees of freedom, the RTO has plenty of levers to deal with virtually any constraint that may occur. The real-time LMP runs as if the constraints are on the traded flowgates that the RTO actually uses to limit flow, not the unrepresented constraint.

In general, not representing a constraint in the network creates a potential opportunity for gaming, since the participant could create congestion on the constraint, then get paid by the RTO to mitigate it. However, in a system with hundreds of flowgates, an individual participant is not likely to be able to
create. much congestion on an unrepresented constraint without exceeding the limit on flowgates that are represented. If the congestion on the unrepresented constraint is due to an equipment failure, the RTO may pay to mitigate the problem, as it would do under FTRs.

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In extreme situations, it may not be possible for the RTO to buy back flowgate rights or redispatch at a reasonable cost. In'these situations, the RTO may be allowed to buy-back rights from participants on a pro-rata basis at a preset ceiling price.

Such bundled point-to-point rights possess at least the following advantages.

Forward price discovery of congestion costs allows planning of unit maintenance, unit commitment, and hydroelectric resources.

Bundled point-to-point rights advantageously minimize market involvement
of RTO in the market, including involvement in the selection of commercially significant flowgates.

Easily traded market instruments for hedging congestion costs, providing virtually complete hedging of risk for participants.

Flowgates provide a mechanism for resolving seams issues between control areas.

0 Bundled point-to-point rights with a flowgate foundation assure least cost redispatch within system constraints.
Bundled point-to-point rights with a flowgate foundation give a complete
set of congestion costs between all locations at delivery time,
Bundled point-to-point rights with a flowgate foundation support participants producing and consuming energy with minimal advance scheduling.

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Bundled point-to-point rights with a flowgate foundation provide the ability to handle large numbers of constraints.

Figure 3B depicts a market interval containing a product type, location and
time interval. The product types may include ephemeral, fungible commodities. All product types may be ephemeral, fungible commodities.

Location may refer to a single node. A node may be specified geographically.

A node may be specified in terms of nodes in a network. The network may

contain both a collection of nodes and a collection of lines, each line extends from a first node to a second node. Note that the term line as used herein lo does not exclusively imply a straight line. A node may be specified in terms of
a node of a network contained in a grid of one or more networks, further containing special lines connecting nodes of potentially distinct networks.

Location may additionally refer to a transition or transfer from a first node to a second node.

A market interval has a uniform price for its product type within the time interval. A market interval may also have uniform buy and sell positions, to support uniform movement of the product within the market interval. A single
market interval may be seen to act as an independent commodity market of the fungible, ephemeral commodity for its product type.

2o Figure 3C depicts a refinement of a market interval as depicted in Figure 313 further containing multiple time intervals.

In Figure 3C, two time intervals are depicted by way of example. More than
two time intervals may be contained in one market interval. Each of the 62
multiple time intervals may not temporally overlap the other contained time intervals of the market interval.

Note that both market positions and market prices may have similar formats.

Both market positions and market prices may include representations as a quantity, which is a scalar value, and a point or set of points over a calendar line known herein as a time interval. Arithmetic functions and operations including, but not limited to, addition, subtraction, negation, multiplication,
minimums and maximums are readily extended to apply to these scalar values over calendar time.

io As stated elsewhere in this document, the minimal condition placed upon the time intervals of a market interval is that they not overlap. It is often advantageous to place further constraints on market intervals in terms of the orders submitted to a virtual trading floor.

These constraints can be thought of as follows: if order market intervals were the footprints on the calendar line, a strip may be considered the shoe that left those footprints. While there may be an indefinitely large number of orders covering the calendar line, there are usually only a small finite number of shoes, i.e. strips involved with those orders. An order's market interval may be further constrained to only begin at discrete points on the calendar line.

By way of example, consider the following strips.

An hourly strip is a market interval that allows orders to be submitted for market intervals that start on the hour and last for an hour.

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A daily strip is a market interval that allows orders to be submitted for market intervals that start on the local time day boundary and end on

local time boundaries. As used here, local time means the local time with respect to the location of the market segment. Note that because the strip is specified in terms of the local time, the actual length may vary depending on the current calendar day at that location. For example, during daylight to standard time transition in the United States, the daily strip spans 25 hours instead of the standard 24 hours.

A daily off-peak strip allows orders for market intervals that start at the local io time day boundary and continue until 6:00 AM local time and then start again at 1 0:00 PM and continue until the ending day boundary.

Other examples may include, but are not limited to, five-minute strips, monthly strips and yearly strips. The set of strips a market may support must ensure
that orders are submitted for non-partially overlapping intervals. These constraints require that strips either be sub-periods of another strip or compliment the strip. An example of two strips, which cannot co-exist in the same market, are the weekly strip and the monthly strip. This is because not all weeks are sub-periods of any one month.

A lot is the quantity in multiples of which an order must be **contracted** .

2o A basic function of a market segment is to match buy and sell orders at a single price. Certain embodiments of the invention will satisfy differing rules established for different markets belonging to different regulatory regions regarding that matching process. By way of example, in a bid-ask market, an incoming buy/sell order is immediately matched with the best buy/sell order
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standing in the market with the trade price as the limit price of the standing order.

In a call-auction market, buy and sell orders are collected together in a batch and matched sometime after they have been submitted. All orders in the.

batch are traded at the same price, which is calculated based upon the limit prices of all orders in the batch.

Figure 3D depicts a macro market interval 1500 for a fungible, ephemeral commodity from Figure 3A.

The invention also comprises a method of a certified client interactively using io a transaction system supporting transactions involving at least one fungible, ephemeral commodity.

Figure 4 depicts a detail flowchart of operation 5000 of Figure 2A-2E for method of a certified client interactively using a transaction system supporting transactions involving at least one fungible, ephemeral commodity.
Arrow 5010 directs the flow of execution from starting operation 5000 to operation 5012. Operation 5012 performs the certified client initiating at least
one action in the transaction system. Arrow 5014 directs execution from operation 5012 to operation 5016. Operation 5016 terminates the operations of this flowchart.

2o The method is further comprised of at least two of the following operations belonging to the basic usage collection.

Arrow 5020 directs the flow of execution from starting operation 5000 to operation 5022. Operation 5022 performs managing at least one user
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resource. Arrow 5024 directs execution from operation 5022 to operation 5016. Operation 5016 terminates the operations of this flowchart.

Arrow 5030 directs the flow of execution from starting operation 5000 to operation 5032. Operation 5032 performs managing a bilateral trading portfolio comprising at least one bilateral trade in at least one of the fungible,
ephemeral commodities. Arrow 5034 directs execution from operation 5032 to operation 5016. Operation 5016 terminates the operations of this flowchart.

Arrow 5040 directs the flow of execution from starting operation 5000 to operation 5042. Operation 5042 performs managing a market position
io portfolio comprising at least one market position of at least one of the fungible,
ephemeral commodities. Arrow 5044 directs execution from operation 5042 to operation 5016. Operation 5016 terminates the operations of this flowchart.

Arrow 5050 directs the flow of execution from starting operation 5000 to operation 5052. Operation 5052 performs managing a market trading collection comprising at least one market trade in at least one of the fungible,
ephemeral commodities. Arrow 5054 directs execution from operation 5052 to operation 5016. Operation 5016 terminates the operations of this flowchart.

Arrow 5060 directs the flow of execution from starting operation 5000 to operation 5062. Operation 5062 performs managing a credit resource collection comprising at least one credit resource. Arrow 5064 directs execution from operation 5062 to operation 5016. Operation 5016 terminates the operations of this flowchart.

Arrow 5070 directs the flow of execution from starting operation 5000 to operation 5072. Operation 5072 performs managing compliance reporting
66
based upon at least one of the collection comprising the user resources, the market position portfolio, the bilateral trading portfolio and the market trading collection. Arrow 5074 directs execution from operation 5072 to operation 5016. Operation 5016 terminates the operations of this flowchart.

Figure 5A depicts a detail flowchart of operation 5012 of Figure 4 for the certified client initiating the action in the transaction system.

Arrow 5190 directs the flow of execution from starting operation 5012 to operation 5192. Operation 5192 performs the certified client initiating a bid for a market interval at a bid price and a bid amount as a first validated order in lo the transaction system. Arrow 5194 directs execution from operation 5192 to operation 5196. Operation 5196 terminates the operations of this flowchart.

Arrow 5200 directs the flow of execution from starting operation 5012 to operation 5202. Operation 5202 performs the certified client initiating an ask for a market interval at a ask price and a ask amount as a second validated order in the transaction system. Arrow 5204 directs execution

from operation
5202 to operation 5196. Operation 5196 terminates the operations of this flowchart.

Arrow 5210 directs the flow of execution from starting operation 5012 to operation 5212. Operation 5212 performs the certified client responding to a
financial commitment presented by the transaction system to create a financial response to the financial commitment in the transaction system.

Arrow 5214 directs execution from operation 5212 to operation 5196.

Operation 5196 terminates the operations of this flowchart.

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Arrow 5220 directs the flow of execution from starting operation 5012 to operation 5222. Operation 5222 performs reporting at least one of the bilateral trades to the transaction system. Arrow'5224 directs execution from operation 5222 to operation 5226. Operation 5226 terminates the operations of this flowchart.

Arrow 5230 directs the flow of execution from starting operation 5012 to operation 5232. Operation 5232 performs confirming at least one of the bilateral trades to the transaction system. Arrow 5234 directs execution from operation 5232 to operation 5226. Operation 5226 terminates the operations io of this flowchart.

Figure 5B depicts a detail flowchart of operation 5212 of Figure 5A for the
certified client responding to the financial commitment presented by the transaction system.

Arrow 5250 directs the flow -of execution from starting operation 5212 to operation 5252, Operation 5252 performs the certified client responding to
the financial commitment presented by the transaction system to create a financial payment of the financial commitment in the transaction system.

Arrow 5254 directs execution from operation 5252 to operation 5256.

Operation 5256 terminates the operations of this flowchart.
Arrow 5260 directs the flow of execution from starting operation 5212 to operation 5262. Operation 5262 performs the certified client responding to the financial commitment presented by the transaction system to create a.

financial counter-response to the financial commitment in the transaction
68
system. Arrow 5264 directs execution from operation 5262 to operation 5256.

Operation 5256 terminates the operations of this flowchart.

Figure 6A depicts a validated order 1200 of the validated order collection.

Validated order 1200 has an associated 1300 market interval 1 1 00-N of the
market interval collection. The market interval collection is separately maintained in certain embodiments of the invention. Maintaining the

validated order collection and market interval collections may be coupled.
Each validated order 1200 further contains a member of the order type collection 1310 which is either a bid order 1312 of the associated 1300 market io interval 1 1 OOmN or an ask validated order 1314 of the associated 1300 market interval 1 1 00-N.

Figure 6B depicts a refinement of Figure 6A of a validated order 1200 of the validated order collection.

As depicted in Figure 6A, validated order 1200 has an associated 1300 market interval 1100-N of the market interval collection. The market interval collection is separately maintained in certain embodiments of the invention.

Maintaining the validated order collection and market interval collections may be coupled.

As depicted in Figure 6A, each validated order 1200 further contains a member of the order type collection 1310 which is either a bid order 13,12 of the associated 1300 market interval II 00-N or an ask validated order 1314 of the associated 1300 market interval 1 1 00-N.

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A validated order may contain 1320 an amount 1322 of the product type 1 1 1 O-N of the associated 1 300 market interval 1 1 00-N.

A validated order may contain 1 330 a price 1 332 of the product type 1 1 1 O-N of the associated 1300 market interval 1 1 00-N.

Figure 7A depicts a refinement of Figure 3B of a market interval of an energy
product type. The product type 1110 of the market interval is further described as an energy product type 1110. The location 1112 is a first node of an AC power network contained in the electrical power grid.

Figure 7B depicts a refinement of Figure 3B of a market interval of an AC io **power transfer** product type. The product type 1110 of the market interval is further described as an Energy product type 1 1 1 0. The location 1 1 12 is from a first node of a first AC power network contained in the electrical power grid to a second node of the first AC power network. Note that this form of location
represents a transmission between the first node of the first AC power network and the second node of the first AC power network.

Figure 7C depicts a refinement of Figure 7B of a market interval of an AC **power transfer** product type. The product type 1 1 1 0 of the market interval is
describedasanEnergyproducttypelIlO. Thelocationlll2isaflowgateof
the flowgate collection of a first AC power network contained in the electrical power grid. Note that flowgates can represent a congestion constraint across more than one transmission line, and may not have a specific first node to second node description.

Such embodiments of the invention of a flowgate market interval are advantageous in providing a market to trade transfer capability between
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users. Because of the linear nature of AC **power transfer** throughout an AC **power** network, these **transfer** rights can be linearly accumulated to insure the **contracted** transfers are physically feasible

in satisfying the overall flowgate constraints of the AC power network.

Figure 7D depicts a refinement of Figures 7B and 7C of a market interval of an AC **power transfer** point-to-point product type. The product type 1 1 1 6 of
the market interval is a refinement of the AC power product type 1110 as depicted in Figure 713. The product type 1 1 16 of the market interval is further described as an Energy product type 1 1 1 0. The location 11 12 is from a first io node of a first AC power network contained in the electrical power grid to a second node of the first AC power network.

Note that as in Figure 7B, this form of location represents a transmission between the first node of the first AC power network and the second node of
the first AC power network. However, a market interval for an AC **power transfer** point-to-point product type further possesses all the ancillary flowgate transmission rights required for the power transmission from the first node to the second node of the AC power network.

Such market intervals support trading in bundles of flowgates rights as pointto-point rights. From a user perspective, point to point rights are what the market participants really want to buy and sell. They are much simpler to deal with and comprehend than flowgate rights.

In terms of maintaining market liquidity, participants should be very comfortable posting bids and offers for point-to-point AC **power transfer** rights, since they constitute complete products from a participant perspective.
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Bids for AC **power transfer** point-to-point market intervals are comprised of bids'-for at least one flowgate transmission right sharing the same location.

Bids for AC **power transfer** point-to-point market intervals may further
comprise bids for each of the flowgates of the flowgate collection sharing the same location. Bids for AC **power transfer** point-to-point market intervals may further comprise transmission rights for at least one flowgate with differing
location. This advantageously supports creating transmissions canceling adverse effects on one or more flowgates.

Figure 8 depicts a validated order 1200 comprised of at least two validated io orders, each with an associated market interval.

Validated order 1200-1 has an associated 1300-1 market interval 1100-N-1 of the market interval collection. Validated order 1200-1 further contains a member of the order type collection 1310-1 which is either a bid order 1312 of the associated 1300 market interval 1 1 00-N-1 or an ask validated order 1314
i5 of the associated 1 300 market interval 1 1 00-N
Validated order 1200-2 has an associated 1300-2 market interval 1100-N-2 of the market interval collection. Validated order 1200-2 further contains a member of the order type collection 1310-2 which is either a bid order 1312 of the associated 1300 market interval 1 1 00-N-2 or an ask validated order 1314 of the associated 1 300 market interval 1 1 00-Nm2.

Validated order 1200-3 has an associated 1300-3 market interval 1100-N-3

of the market interval collection. Validated order 1200-3 further contains a member of the order type collection 1310-3 which is either a bid order 1312 of
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the associated 1 300 market interval 1 1 00-N-3 or an ask validated order 1 31 4
of the associated 1300 market interval 1 1 00-N
There may be no specific limit to the number of validated orders comprising a
validated order. There may be a limit to the number of validated orders comprising a validated order.

The associated market intervals of multiple validated orders within a validated order may share the same product type. The associated market intervals of
multiple validated orders within a validated order may share the same location.

io The associated market intervals of multiple validated orders within a validated order may differ in product type. The associated market intervals of multiple validated orders within a validated order may differ in location.

As discussed in the background, the physics of AC power networks indicates each AC power network contained in the electrical power grid further contains a flowgate collection of flowgates. Each flowgate location being either from
an associated first node of the AC power network to an associated second node of the AC power network, or in the case of a collection of constrained transmission lines, will be denoted by a flowgate designator. An AC **power**
transfer amount from nodel to node2 produces an amount of AC **power** **transfer** across the flowgate as essentially an associated linear, skew symmetric function of the amount from nodel to node2, for each of the flowgates of the flowgate collection. For each of the flowgates of the flowgate collection, there is at least one market interval in the market interval collection of AC **power** **transfer** product type with the flowgate'location.

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Each validated order of the validated order collection with the AC **power**

transfer product type of the associated market interval may further contain an amount. A validated order of AC **power** **transfer** product type from the first node to the second node may be further comprised of a validated order of the flowgate associated market interval. The amount ordered for that flowgate is essentially the associated linear, skew-symmetric function of the amount from the first node to the second node, for each of the flowgates of the flowgate collection.

Note that there may be a price associated with each validated order of the AC io **power** **transfers** of the flowgates. There may be a price associated with the AC **power** **transfer** from the first node to the second node.

Figure 9A depicts a market interval of a DC power line. An electrical power grid may further contain a DC power line collection of at least one DC power line at the location of the DC power line from a first node of a first AC power
network to a second node of a second AC power network. The product type

collection further comprises DC **power transfer** . For each DC power line of the DC power line collection, there is at least one associated market interval with DC **power transfer** product type, with the location as the location of the DC power line.

Figure 9B depicts market interval 1100 of Figure 3B further containing a window time interval during which the market interval is active only within the window time interval. The window time interval of the market interval entirely occurs before the time interval contained in the market interval for each market interval.

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Figure 9C depicts market interval II 00 of Figure 9B containing a window time interval and multiple time intervals. Each of the time intervals does not overlap the other time intervals. The window time interval occurs before each of the time intervals.

Note that the invention may comprise managing more than one generator of a fungible, ephemeral commodity. The invention may include managing a first
generator of a first fungible, ephemeral commodity and managing a second generator of a second fungible, ephemeral commodity. The invention may also include managing a generator of more than one fungible, ephemeral lo commodity.

The invention may include managing more than one load consuming a fungible, ephemeral commodity. The invention may include managing a first load consuming a first fungible, ephemeral commodity and managing a second load consuming a second fungible, ephemeral commodity. The invention may also include managing a load consuming more than one fungible, ephemeral commodity.

The invention may include managing more than one import providing a fungible, ephemeral commodity. The invention may include' managing a first
import providing a first fungible, ephemeral commodity and managing a second import providing a second fungible, ephemeral commodity.-.The invention may also include managing a import providing more than one fungible, ephemeral commodity.

The invention may include managing more than one export consuming a fungible, ephemeral commodity. The invention may include managing a first
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export consuming a first fungible, ephemeral commodity and managing a second export consuming a second fungible, ephemeral commodity. The invention may also include managing an export consuming more than.one fungible, ephemeral commodity.

As used herein, presenting something to a certified client who is human may include, but is not limited to, visually displaying that something, placing a
presentation of that something into a windowing system, which may be directed to display the something by the human and acoustically presenting that something to the certified client.

Presenting something to a certified client operating a computer interacting within the transaction system may further include, but is not limited to, transmitting a presentation of the something to the client computer. The client computer may further receive and process the presentation.

Presenting something to a software agent operating a software agent computer may include, but is not limited to, inserting or adding the processed presentation into a fact database accessible by the software agent.

Figure 10 depicts a view of certified client user interface 7000 showing an ordering screen with hourly time interval based market intervals for a specific energy market.

2o Note that in Figures 10 to 16, which show various views of certified client user interfaces, managing a market trading,position portfolio is illustrated based upon the assumption that the certified client is actively trading.

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In circumstances where the certified client is not actively trading, as for instance in situations regarding certified clients such as homes, factories and farms consuming and/or generating power below the minimum lot size, minor variants of Figures 10 to 16 would show the market position portfolios.

In general, managing a market trading portfolio is similar to managing a market position-portfolio with the added capability
Client display screen 7000 may interactively show the market state of a number of related market intervals. Client display screen 7000 may indicate the market state of market intervals sharing the same product type 7004 and io location 7002 and for successive time intervals 7008 for November 11, 1998 as indicated by highlighted lettering in calendar 7030.

The column 7006 labeled "Market Time Hour Ending (ST)" has a succession of rows with entries from 1 to 24, indicating the hourly energy markets 7004 in the Illinois sell zone 7002. Consider the row labeled by the hour 7008 ending at "3". This row displays the market state of the market interval with energy product type, Illinois sell zone location and hour time. interval ending at 3:00 for November 11, 1998. The current market price in dollars per megawatt
hour 7010 is "12.96". The **contracted** position in net megawatts 7012 is "12.00". The pending position in net megawatts 7014 is "13.00". The total position in net megawatts 7016 is "25.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net
megawatts-hours 7018 is "26.98". The highest bid price in dollars per megawatt-hour 7020 is "1 1.71 ". The highest ask quantity in net megawattshours 7022 is "38.84". The highest ask price in dollars per megawatt-hour 7024 is "14.21".
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Figure 11 depicts a view of certified client user interface 7100 showing an ordering screen for daily on-peak time interval based market intervals for a specific energy market.

Client display screen 7100 may interactively show the market state of a number of related market intervals. Client display screen 7100 may indicate the market state of market intervals sharing the same product type 7104 and location 7102 and for successive time intervals 7106 from November 7, 1998 to November 24, 1998 as indicated by highlighted lettering in calendar 7130.

Consider the row for 1 1/1 2/1998.

lo The column labeled "Market Time Day Ending" has a succession of rows with entries from 11/07/1998 to 11/23/1998, indicating the daily on peak energy markets 7104 in the Illinois sell zone 7102.

The current market price in dollars per megawatt-hour 7110 is "16.72". The **contracted** position in net megawatts 7112 is 1 0.00". The pending position in i5 net megawatts 7114 is "O.W. The total position in net megawatts 7116 is "1 0.00", which is the sum of the **contract** and pending positions for that market interval. The highest bid quantity in net megawatts-hours,7118 is "25.50". The highest bid price in dollars per megawatt-hour 7120 is "20.61". The lowest ask quantity in net megawatts-hours 7122 is "35.50". The lowest ask price in 2o dollars per megawatt-hour 7124 is "23.28".

Figure 12 depicts a view of certified client user interface 7200 showing an ordering screen for hourly time interval based market intervals for a specific flowgate market.

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The displayed information 7200 includes a variety of fields, including field 7202, where a specific flowgate or intertie may be selected. Immediately below that field is field 7204 specifying commodity type, in this case, "Hourly Flowgate". The column indicated by 7210 represents. the current market price, The column to its right 7212 indicates the amount of the commodity already awarded. The box 7206 points to two columnar components. The left component represents the bid quantity and the right component represents the bid price per unit quantity on each row. Note that each row represents a distinct market interval, trading'independently of the other market intervals.

io Client display screen 7200 may show the market state of a number of related
6
market intervals, may indicate the market state of market intervals sharing the same product type 7204 and location 7202 and for successive time intervals for May 10, 1999 as indicated by highlighted lettering in calendar 7230.

The column labeled "Market Time Hour Ending (DT)" 7208 has a succession of rows with entries from 1 to 24, indicating the hourly AC **power transfer** markets 7204 in the flowgate location "Flowgate-a" 7202. Consider the row labeled by the hour 7208 ending at "V. This row displays the market state of the market interval with AC **power transfer** product type, flowgate 7202 location and hour time interval ending at 1:00 for May 10, 1999. The current market price in dollars per megawatt-hour 7210 is "O.00". The **contracted** position in net megawatts 7212 is "O.00". The pending position in net megawatts 7214 is "O.00". The total position in net megawatts 7216 is "O.00", which is the sum of the **contract** and pending positions for that market interval.

The **contracted** flow 7224 is "O.00". The pending flow 7226 is "O.00". The total flow 7228 is "O.00".

The user interface supporting many flowgates may be very similar to Figures
10, 11 and 12, with some added features. In the Energy Market screen of Figures 1 0 and 1 1 , there are columns showing the market position in terms of bid and ask summaries.

Figure 13 depicts a view of certified client user interface 7300 showing an ordering screen for hourly time interval based market intervals with respect to a specific facility ("Hyatt Generation") including energy transmission costs from multiple displayed markets.

The more specific information on energy and transmission prices are available in the tabs at the bottom of the screen. There is an "Interval Depth" tab
(which may be called "All Market Depth") and a "Market Depth" tab (which may be called "Single Market Depth").

The "Transmission requirements" tab shows the required flowgate transmission rights for a point-to-point transmission from the Hub to the is business location.

The column labeled 7302 shows the transmission cost to buy energy at the hub (Market) and transfer it to the business location (Hyatt Generation).

The column labeled 7304 shows the transmission cost to sell energy at the hub (Market) and transfer from the business location (Hyatt Generation).

Costs 7302 and/or 7304 may be calculated from current market price of the required flowgate market intervals.

Certain embodiments of the invention include dynamic creation of transmission bids and offers shown in the Energy Market screen. When a so
participant opens the Energy Market screen for a particular facility, market, strip, and lot size, a signal is sent to the market makers. They may respond with bids and offers tailored for this particular screen. The dynamic capability may be needed because it is not feasible for market makers to continuously post bids and offers between every hub and every facility location.

Certain embodiments include "Transmission from Hub Depth" and "Transmission to Hub Depth" tabs. These tabs may show, in addition to quantity, price, and possibly credit, codes identifying the market maker making the bid or offer. The reason this information is needed is that different io market makers may be relying on reconfiguring the same standing bids and offers to create their bids and offers. Hence, if the participant lifts or hits one of these bids or offers, the other market maker will likely withdraw their corresponding bid or offer. When a participant sees similar bids or offers from two different market makers, it is probably only possible to hit or lift one of them. Another way to deal with this problem might be to only display a stack of bids or offers from one market maker at a time-perhaps the one offering the best price.

When the participant enters a buy or sell order in the appropriate columns and presses the "submit" button, the user interface may display the energy order 2o and a listing of all the flowgates and the transmission quantity through the flowgate required to deliver the energy. The user can check off which orders he/she wishes to place. The user may check all items to do a complete "all-in" order.

Alternatively, the invention includes at least one mechanism where most users could avoid any direct dealings in flowgates. The energy order may be
81
displayed, along with a single order to buy (for energy purchases) or sell (for energy sales) transmission in the direction of the energy flow, and another order to sell or buy transmission in the direction against the energy flow. The user may check all three items to do a complete "all-in" order. The user who
wished to buy energy and transmission without incurring any obligations clicking only the first line, or transmission only orders by clicking one or both of the transmission lines.

The advantage of this macromarket trading scheme, is that there is just one
io transaction including the source generation, transmission rights and destination loading, where applicable, which preferably becomes a single **contract** . This creates a fundamental simplification in the conceptual effort required to trade energy delivery.
Figure 14 depicts a view of certified client user interface 7400 showing an ordering screen for hourly time interval based market intervals from a trade book perspective.

Trade books are useful in the preliminary stages of trading energy, when the principal requirement is to create production and load commitments. A trade book has no business location. By way distinction, a facility always has a location.

Many power utility companies, as well as facilities operators employ a trade book approach for initial, relatively time-distant energy trading, and then switch to a facility based energy trading activity as the time approaches when
82
scheduling the energy delivery becomes relevant. Such tasks are often performed by two separate groups of people within such organizations.

Note that the certified client may select various markets and at least the presentation use of the visible columns, which become part of the user view,
which can be saved, selected and presented by name, such as "CA Hourly/Daily" in field 7402.
Note that this may effect and/or control the ordering of columns, rows, and/or
the sorting of columns and/or rows
Figure 15 depicts a view of certified client user interface 7500 showing an lo overview trading position for specific hours of two successive days including the trade book and a limited number of certified clients.

A certified client may use view 7500 in the scheduling process.

Figure 16 depicts a detailed view of certified client user interface 7600 showing the trading position for specific hours of two successive days with regards to one certified client based upon Figure 15.

Figure 16 is sometimes referred to as a "drill down" from Figure 15.

Figure 17 depicts a view of certified client user interface 7700 providing an
overview of the reports on transactions and/or schedules available for

presentation to the user.

2o Figure 18 depicts a view of certified client user interface 7800 providing a detailed view of the monthly invoice for the certified client including fees to the
83
transaction engine service provider, who may be a first party, (APX Fees 7802).

Note individual financial obligations 7804 are shown as owed by the certified client to the first party. Responses to the financial statement include payment of the obligation 7804 to the first party. Such payments are a product of the process of using the transaction system of this invention.

Further note that there are potentially several first parties to whom or from
whom moneys may,be owed or are owing: A service provider supporting at least some of the operations of Figure 4 such as APX may be a first party; a lo regulatory agency may be a first party; A network operator may be a first party ; A public utility company; And often at least one other certified client,
who performed or received benefit from the performance of a commitment through use of the transaction system, may also be a first party.

Figure 19 depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource.

Arrow 5360 directs the flow of execution from starting operation 5022,to operation 5362. Operation 5362 performs managing a generator of at least one of the fungible, ephemeral commodities. Arrow 5364-directs execution from operation 5362 to operation 5366. Operation 5366 terminates the operations of this flowchart.

Arrow 5370 directs the flow of execution from starting operation 5022 to operation 5372. Operation 5372 performs managing a load consuming at least one of the fungible, ephemeral commodities. Arrow 5374 directs
84
execution from operation 5372 to operation 5366. Operation 5366 terminates the operations of this flowchart.

Arrow 5380 directs the flow of execution from starting operation 5022 to operation 5382. Operation 5382 performs managing a transmission facility for
at least one of the fungible, ephemeral commodities. Arrow 5384 directs execution from operation 5382 to operation 5366. Operation 5366 terminates the operations of this flowchart.
Arrow 5390 directs the flow of execution from starting operation 5022 to operation 5392. Operation 5392 performs managing an import providing at io least one of the fungible, ephemeral commodities. Arrow 5394 directs execution from.operation 5392 to operation 5366. Operation 5366 terminates the operations of this flowchart.

Arrow 5400 directs the flow of execution from starting operation 5022 to operation 5402. Operation 5402 performs managing an export consuming at least one of the fungible, ephemeral commodities. Arrow 5404 directs execution from operation 5402 to operation 5366. Operation 5366 terminates the operations of this flowchart.

Figure 20A depicts a detail flowchart of operation 5022 of Figure 4 for

managing the user resource.

2o Arrow 5450 directs the flow of execution from starting operation 5022 to operation 5452. Operation 5452 performs creating a first knowledge interval of the ephemeral, fungible commodity at a first time interval containing a first cost in the knowledge interval collection. Arrow 5454 directs execution from
85
operation 5452 to operation 5456. Operation 5456 terminates the operations of this flowchart.

Certain embodiments of the invention include at least one of the two following operations.

Arrow 5460 directs the flow of execution from starting operation 5022 to operation 5462. Operation 5462 performs maintaining a bid interval collection of bid intervals of the ephemeral, fungible commodity, each comprised of a bid price, a bid amount, and a bid time interval. Arrow 5464 directs execution
from operation 5462 to operation 5456. Operation 5456 terminates the lo operations of this flowchart.

Arrow 5470 directs the flow of execution from starting operation 5022 to operation 5472. Operation 5472 performs maintaining an ask interval collection of ask intervals of the ephemeral, fungible commodity, each comprised of a ask price, a ask amount, and a ask time interval. Arrow 5474
directs execution from operation 5472 to operation 5456. Operation 5456 terminates the operations of this flowchart.

Note that these bid intervals and ask intervals may be related or the same as the bids and asks initiated by the certified client. Such bids and asks may alternatively be integrated into a market trading portfolio.

2o Figure 20B depicts a detail flowchart of operation 5452 of Figure 20A for creating the first knowledge interval.

Arrow 5490 directs the flow of execution from starting operation 5452 to operation 5492. Operation 5492 performs receiving a knowledge interval
86
creation message to create a received knowledge i.nterval creation message.

Arrow 5494 directs execution from operation 5492 to operation 5496.

Operation 5496 terminates the operations of this flowchart.

Arrow 5500 directs the flow of execution from starting operation 5452 to operation 5502. Operation 5502 performs creating the first knowledge interval of the ephemeral, fungible commodity at the first time interval containing the
first cost in the knowledge interval collection based upon the received knowledge interval creation message. Arrow 5504 directs execution from operation 5502 to operation 5496. Operation 5496 terminates the operations lo of this flowchart.

Figure 21A depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource.

Arrow 5570 directs the flow of execution from starting operation 5022 to

operation 5572. Operation 5572 performs determining the ephemeral, fungible commodity needs over a planning time interval. Arrow 5574 directs execution from operation 5572 to operation 5576. Operation 5576 terminates the operations of this flowchart.

Arrow 5580 directs the flow of execution from starting operation 5022 to operation 5582. Operation 558:2 performs determining an equipment usage plan based upon the knowledge interval collection containing an equipment usage item of the user resource to create a resource operating schedule.

Arrow 5584 directs execution from operation 5582 to operation 5576.

Operation 5576 terminates the operations of this flowchart.

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The equipment usage item of the user resource is comprised of an activation time and an action belonging to an action collection comprising start-action, stop-action and throttle-action.

Arrow 5590 directs the flow of execution from starting operation 5022 to operation 5592. Operation 5592 performs operating the equipment usage item of the user resource based upon the device operating schedule. Arrow 5594 directs execution from operation 5592 to operation 5576. Operation 5576 terminates the operations of this flowchart.

Figure 21B depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource.

Arrow 5610 directs the flow of execution from starting operation 5022 to operation 5612. Operation 5612 performs examining an equipment usage collection comprised of equipment usage entries to create the ephe meral, fungible commodity needs over the planning time interval. Arrow 5614 directs execution from operation 5612 to operation 5616. Operation 5616 terminates the operations of this flowchart.

Each equipment usage entries contains a delivery time and a need schedule for the ephemeral, fungible commodity. The ephemeral, fungible commodity needs over the planning time interval comprise an amount.

The ephemeral, fungible commodity needs over the planning time interval further comprise a cost limit.

Figure 21C depicts a detail flowchart of operation 5192 of Figure 5A for the certified client initiating the bid.

88
Arrow 56X directs the flow of execution from starting operation 5192 to operation 5632. Operation 5632 performs making the bid of a first bid amount at a first bid price within the cost limit for the first time interval of the ephemeral, fungible commodity. Arrow 5634 directs execution from operation
5632 to operation 5636. Operation 5636 terminates the operations of this flowchart.

Figure 22 depicts a detail flowchart of operation 5592 of Figure 21A for operating the equipment usage item.

Arrow 5670 directs the flow of execution from starting operation 5592 to lo operation 5672. Operation 5672 performs starting the equipment usage item of the user resource based upon the device operating schedule. Arrow

5674
directs execution from operation 5672 to operation 5676. Operation 5676 terminates the operations of this flowchart.

Arrow 5680 directs the flow of execution from starting operation 5592 to operation 5682. Operation 5682 performs stopping the equipment usage item of the user resource based upon the device operating schedule. Arrow 5684 directs execution from operation 5682 to operation 5676. Operation 5676 terminates the operations of this flowchart.

Arrow 5690 directs the flow of execution from starting operation 5592 to operation 5692. Operation 5692 performs throttling the equipment usage item of the user resource based upon the device operating schedule. Arrow 5694
directs execution from operation 5692 to operation 5676. Operation 5676 terminates the operations of this flowchart.

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Figure 23A depicts a detail flowchart of operation 5042 of Figure 4 for managing the market position portfolio.
Arrow 5710 directs the flow of execution from starting operation 5042 to operation 5712. Operation 5712 performs maintaining a market window.

Arrow 5714 directs execution from operation 5712 to operation 5716.

Operation 5716 terminates the operations of this flowchart.

Arrow 5720 directs the flow of execution from starting operation 5042 to operation 5722. Operation 5722 performs maintaining a local market position
portfolio comprised of at least one market position summary. Arrow 5724 io directs'execution from operation 5722 to operation 5716. Operation 5716 terminates the operations of this flowchart.

Each of the market position summaries includes a market interval of the fungible, ephemeral commodity within the market window.

Arrow 5730 directs the flow of execution from starting operation 5042 to operation 5732. Operation 5732 performs presenting the local market position portfolio based upon the market window. Arrow 5734 directs execution from operation 5732 to operation 5716. Operation 5716 terminates the operations of this flowchart.
Figure 23B depicts a detail flowchart of operation 5732 of Figure 23A for presenting the local market position portfolio.

Arrow 5750 directs the flow of execution from starting operation 5732 to operation 5752. Operation 5752 performs presenting at least one of the market position summaries including the market interval within the market
90
window. Arrow 5754 directs execution from operation 5752 to operation 5756. Operation 5756 terminates the operations of this flowchart.

Note that at least one of the market position summaries of the local market
position portfolio may include an amount-held, a current bid summary, a 5 ' current ask summary, a current market price and a current order summary.

Figure 24 depicts a detail flowchart of operation 5752 of Figure 23B for presenting the market position summary.

Arrow 5770 directs the flow of execution from starting operation 5752 to operation 5772. Operation 5772 performs presenting the included market io interval. Arrow 5774 directs execution from operation 5772 to operation 5776.

Operation 5776 terminates the operations of this flowchart.

Arrow 5780 directs the flow of execution from starting operation 5752 to operation 5782. Operation 5782 performs presenting the amount-held. Arrow 5784 directs execution from operation 5782 to operation 5776. Operation 5776 terminates the operations of this flowchart.

Arrow 5790 directs the flow of execution from starting operation 5752 to operation 5792. Operation 5792 performs presenting the current bid summary. Arrow 5794 directs execution from operation 5792 to operation 5776. Operation 5776 terminates the operations of this flowchart.

2o Arrow 5800 directs the flow of execution from starting operation 5752 to
operation 5802. Operation 5802 performs presenting the current ask summary. Arrow 5804 directs execution from operation 5802 to operation 5776. Operation 5776 terminates the operations of this flowchart.

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Arrow 5810 directs the flow of execution from starting operation 5752 to operation 5812. Operation 5812 performs presenting the current market price. Arrow 5814 directs execution from operation 5812 to operation 5776.

Operation 5776 terminates the operations of this flowchart.

Arrow 5820 directs the flow of execution from starting operation 5752 to operation 5822. Operation 5822 performs presenting the current order summary. Arrow 5824 directs execution from operation 5822 to operation 5776. Operation 5776 terminates the operations of this flowchart.

Figure 25A depicts a, detail flowchart of operation 5000 of Figure 4 for the lo method of using the transaction system.

Arrow 5830 directs the flow of execution from starting operation 5000 to operation 5832. Operation 5832 performs maintaining a market position database. Arrow 5834 directs execution from operation 5832 to operation 5836. Operation 5836 terminates the operations of this flowchart.

Figure 25B depicts a detail flowchart of operation 5832 of Figure 25A for maintaining the market position database.
Arrow 5850 directs the flow of execution from starting operation 5832 to operation 5852. Operation 5852 performs maintaining at least one market position containing at least'one of the market intervals. Arrow 5854 directs 2o execution from operation 5852 to operation 5856. Operation 5856 terminates the operations of this flowchart.

Figure 26 depicts a detail flowchart of operation 5852 of Figure 25B for maintaining the market position.

92
Arrow 5860 directs the flow of execution from starting operation 5852 to operation 5862. Operation 5862 performs maintaining an amount7held' associated with the market interval. Arrow 5864 directs execution from

operation 5862 to operation 5866. Operation 5866 terminates the operations of this flowchart.

Arrow 5870 directs the flow of execution from starting operation 5852 to operation 5872. Operation 5872 performs maintaining a current bid list associated with the market interval including at least one current bid associated with the market interval. Arrow 5874 directs execution from io operation 5872 to operation 5866. Operation 5866 terminates the operations of this flowchart.
Arrow 5880 directs the flow of execution from starting operation 5852 to operation 5882. Operation 5882 performs maintaining a current ask list associated with the market interval including at least one ask associated with
the market interval. Arrow 5884 directs execution from operation 5882 to operation 5866. Operation 5866 terminates the operations of this flowchart.

Arrow 5890 directs the flow of execution from starting operation 5852 to operation 5892. Operation 5892 performs maintaining a current market price
associated with the market interval. Arrow 5894 directs execution from operation 5892 to operation 5866. Operation 5866 terminates the operations of this flowchart.

Arrow 5900 directs the flow of execution from starting operation 5852 to operation 5902. Operation 5902 performs maintaining a current order list associated with the market interval. Arrow 5904 directs execution from
93
operation 5902 to operation 5866. Operation 5866 terminates the operations of this flowchart.
Certain embodiments of the invention support at least one of the operations of Figure 26.

Note that at least one of the market intervals contains an AC **power transfer** product type as the fungible, ephemeral commodity and contains the location as a first of the nodes directed to a second of the nodes of the AC power network node collection.

Figure 27A depicts a detail flowchart of operation 5042 of Figure 4 for io maintaining the local market position portfolio.

Arrow 5910 directs the flow of execution from starting operation 5042 to operation 5912. Operation 5912 performs calculating the current bid summary from the market position database based upon the business location. . Arrow 5914 directs execution from operation 5912 to operation 5916. Operation 5916 terminates the operations of this flowchart.

Arrow 5920 directs the flow of execution from starting operation 5042 to operation 5922. Operation 5922 performs calculating the current ask summary from the market position database based upon the business location. Arrow 5924 directs execution from operation 5922 to operation 2o 5916. Operation 5916 terminates the operations of this flowchart.
Arrow 5930 directs the flow of execution from starting operation 5042 to operation 5932. Operation 5932 performs calculating the current market price from the market position database based upon the business location.
Arrow
94
directs execution from operation 5932 to operation 5916. Operation 5916 terminates the operations of this flowchart.

Figure 27B depicts a detail flowchart of operation 5000 of Figure 2A-2E for the method of using the transaction system.

1
Arrow 5940 directs the flow of execution from starting operation 5000 to operation 5942. Operation 5942 performs establishing a client node belonging to the node collection of the AC power network as the business location. Arrow 5944 directs execution from operation 5942 to operation 5946. Operation 5946 terminates the operations of this flowchart.

lo Note that the operations of Figure 27A may each be further based upon the flowgate collection.

The market interval may contain the AC **power transfer** product type as the fungible, ephemeral commodity and further, the market interval may contain an AC **power transfer** point-to-point product type as the fungible, ephemeral commodity.

Figure 28A depicts a detail flowchart of operation 5000 of Figure 2A-2E for the method of using the transaction system.

Arrow 5950 directs the flow of execution from starting operation 5000 to operation 5952. Operation 5952 performs maintaining a flowgate collection containing at least two flowgate entries. Arrow 5954 directs execution from operation 5952 to operation 5956. Operation 5956 terminates the operations of this flowchart.

95
Each flowgate entry contained in the flowgate collection may include a factor, a from-node of the node collection and a to-node of the node collection.

For each of the flowgate entries contained in the flowgate collection, at least one of the market intervals contains the AC **power transfer** product type as the fungible, ephemeral commodity and the location coinciding with the flo'wgate entry.
Note that as new transmission resources become available, the flowgate collection may be altered. Note also that if transmission resources become damaged, as for instance may result from a hurricane, the flowgate collection io may also be altered.

Figure 28B depicts a detail flowcha rt of operation 5872 of Figure 26 for maintaining the current bid list.

Arrow 5970 directs the flow of execution from starting operation 5872 to operation 5972. Operation 5972 performs receiving a request for a point-topoint bid associated with the market interval to create a received point-to-point bid request. Arrow 5974 directs execution from operation 5972 to operation 5976. Operation 5976 terminates the operations of this flowchart.

Arrow 5980 directs the flow of execution from starting operation 5872 to operation 5982. Operation 5982 performs generating a point-to-point bid 2o associated with the market interval based upon the received bid request to create a new point-to-point bid associated with the market interval. Arrow
5984 directs execution from operation 5982 to operation 5976. Operation 5976 terminates the operations of this flowchart.
96
Note that certified client market makers 1440 may actively use the

operations of Figure 28B.

Figure 29 depicts a detail flowchart of operation 5032 of Figure 4 for managing the bilateral trading portfolio.

Arrow 8010 directs the flow of execution from starting operation 5032 to operation 8012. Operation 8012 performs receiving an authenticated bilateral trade notification message to create a received bilateral trade notification
message. Arrow 8014 directs execution from operation 8012 to operation 8016. Operation 8016 terminates the operations of this flowchart.

io Arrow 8020 directs the flow of execution from starting operation 5032 to
operation 8022. Operation 8022 performs updating the bilateral trading portfolio based upon the received bilateral trade notification message. Arrow
8024 directs execution from operation 8022 to operation 8016. Operation 8016 terminates the operations of this flowchart.
Arrow 8030 directs the flow of execution from starting operation 5032 to operation 8032. Operation 8032 performs generating an initial bilateral trade.

Arrow 8034 directs execution from operation 8032 to operation 8016.

Operation 8016 terminates the operations of this flowchart.

Arrow 8040 directs the flow of execution from starting operation 5032 to operation 8042. Operation 8042 performs processing the initial bilateral trade to create an initial bilateral trade message. Arrow 8044 directs execution from operation 8042 to operation 8016. Operation 8016 terminates the operations of this flowchart.

97
Arrow 8050 directs the flow of execution from starting operation 5032 to operation 8052. Operation 8052 performs inserting the initial bilateral trade
into the bilateral trading portfolio. Arrow 8054 directs execution from operation 8052 to operation 8016. Operation 8016 terminates the operations of this flowchart.
Arrow 8060 directs the flow of execution from starting operation 5032 to operation 8062. Operation 8062 performs sending the initial bilateral trade
message. Arrow 8064 directs execution from operation 8062 to operation 8016. Operation 8016 terminates the operations of this flowchart.

io Arrow 8070 directs the flow of execution from starting operation 5032 to
operation 8072. Operation 8072 performs receiving a bilateral trade confirmation message to create a received bilateral trade confirmation request. Arrow 8074 directs execution from operation 8072 to operation 8016. Operation 8016 terminates the operations of this flowchart.

Arrow 8080 directs the flow of execution from starting operation 5032 to operation 8082. Operation 8082 performs inserting the received bilateral trade confirmation request into the bilateral trading portfolio. Arrow
8084
directs execution from operation 8082 to operation 8016. Operation 8016 terminates the operations of this flowchart.

Figure 30A depicts a detail flowchart of operation 5032 of Figure 4 for managing the bilateral trading portfolio.
Arrow 8110 directs the flow of execution from starting operation 5032 to operation 8112. Operation 8112 performs responding to the received bilateral trade confirmation request to create a bilateral trade confirmation response.

98
Arrow 8114 directs execution from operation 8112 to operation 8116.

Operation 8116 terminates the operations of this flowchart.

Arrow 8120 directs the flow of execution from starting operation 5032 to operation 8122. Operation 8122 performs inserting the bilateral trade confirmation response into the bilateral trading portfolio. Arrow 8124 directs execution from operation 8122 to operation 8116. Operation 8116 terminates the operations of this flowchart.

Arrow 8130 directs the flow of execution from starting operation 5032 to operation 8132. Operation 8132 performs processing the bilateral trade lo confirmation response to create a bilateral trade confirmation response
message. Arrow 8134 directs execution from operation 8132 to operation 8116. Operation 8116 terminates the operations of this flowchart.
Arrow 8140 directs the flow of execution from starting operation 5032 to operation 8142. Operation 8142 performs sending the bilateral trade confirmation response message. Arrow 8144 directs execution from operation 8142 to operation 8116. Operation 8116 terminates the operations of this flowchart.

Figure 30B depicts a detail flowchart of operation 5062 of Figure 4 for managing the credit resource collection, for each of the credit resources of the credit resource collection.

Arrow 8150 directs the flow of execution from starting operation 5062 to operation 8152. Operation 8152 performs managing the credit resource.

Arrow 8154 directs execution from operation 8152 to operation 8156.

Operation 8156 terminates the operations of this flowchart.

99
Figure 31 depicts a detail flowchart of operation 8152 of Figure 30B for managing the credit resource, for at least one of the credit resources of the.
credit resource collection.

Arrow 8160 directs the flow of execution from starting operation 8152 to operation 8162. Operation 8162 performs receiving a credit resource message to create a received credit resource message. Arrow 8164 directs execution from operation 8162 to operation 8166. Operation 8166 terminates the operations of this flowchart.

Arrow 8170 directs the flow of execution from starting operation 8152 to lo operation 8172. Operation 8172 performs updating the credit resource based
upon the received credit resource message. Arrow 8174 directs execution from operation 8172 to operation 8166. Operation 8166 terminates the operations of this flowchart.

Arrow 8180 directs the flow of execution from starting operation 8152 to operation 8182. Operation 8182 performs presenting the credit resource.

Arrow 8184 directs execution from operation 8182 to operation 8166.

Operation 8166 terminates the operations of this flowchart.
Arrow 8190 directs the flow of execution from starting operation 8152 to operation 8192. Operation 8192 performs preparing a credit resource request
message. Arrow 8194 directs execution from operation 8192 to operation 8166. Operation 8166 terminates the operations of this flowchart.

Arrow 8200 directs the flow of execution from starting operation 8152 to operation 8202. Operation 8202 performs sending the credit resource request message to create a sent credit request. Arrow 8204 directs execution from
100
operation 8202 to operation 8166. Operation 8166 terminates the operations of this flowchart.

Note that one or more of the operations of Figure 31 may act as refinements of one or more of the operations of Figure 5B and/or act as a refinement of operation 5212 of Figure 5A.

Figure 32A depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource.

Arrow 8230 directs the flow of execution from starting operation 5022 to operation 8232. Operation 8232 performs receiving a user resource schedule lo including a time interval to create a received schedule for the time interval.

Arrow 8234 directs execution from operation 8232 to operation 8236.

Operation 8236 terminates the operations of this flowchart.

Arrow 8240 directs the flow of execution from starting operation 5022 to operation 8242. Operation 8242 performs updating an operating schedule for the user resource based upon the received schedule for the time interval to create the operating schedule containing an operating schedule entry for the time interval. Arrow 8244 directs execution from operation 8242 to operation 8236. Operation 8236 terminates the operations of this flowchart.

Arrow 8250 directs the flow of execution from starting operation 5022 to operation 8252. Operation 8252 performs maintaining a real-time. Arrow 8254 directs execution from operation 8252 to operation 8236. Operation 8236 terminates the operations of this flowchart.

101
Arrow 8260 directs the flow of execution from starting operation 5022 to operation 8262. Operation 8262 performs controlling the user resource based upon the operating schedule for the user resource and based upon the realtime. Arrow 8264 directs execution from operation 8262 to operation 8236.

Operation 8236 terminates the operations of this flowchart.

Note that a market trading system component and a scheduling system component within the transaction system may use the same real-time

clocking scheme, or separate and distinct real-time clocking schemes. This will effect
operating the equipment usage item 5592, maintaining the market window lo 5712, by way of example. The market window preferably closes long enough before the real-time it refers to, so that all commitments are scheduled, and
those schedules received by the certified client reliably. ###
The operating schedule entry for the time interval contained in the operating schedule for the user resource may include a capacity option item.

Figure 32B depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource.

Arrow 8290 directs the flow of execution from starting operation 5022 to operation 8292. Operation 8292 performs sending a capacity option exercise message for the time interval based the capacity option item to create a sent capacity option exercise. Arrow 8294 directs execution from operation 8292 to operation 8296. Operation 8296 terminates the operations of this flowchart.

Arrow 8300 directs the flow of execution from starting operation 5022 to operation 8302. Operation 8302 performs updating the operating schedule entry for the time interval based upon the sent capacity option exercise.

102
Arrow 8304 directs execution from operation 8302 to operation 8296.

Operation 8296 terminates the operations of this flowchart.

Figure 33A depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource.

Arrow 8330 directs the flow of execution from starting operation 5022 to operation 8332. Operation 8332 performs receiving a capacity exercise acknowledgment based upon the sent-capacity option exercise to create a received capacity exercise acknowledgment. Arrow 8334 directs execution from operation 8332 to operation 8336. Operation 8336 terminates the lo operations of this flowchart.

Arrow 8340 directs the flow of execution from starting operation 5022 to operation 8342. Operation 8342 performs updating the operating schedule entry for the time interval based upon the received capacity exercise acknowledgment. Arrow 8344 directs execution from operation 8342 to operation 8336. Operation 8336 terminates the operations of this flowchart.

In certain embodiments of the invention, a sent capacity option exercise includes an exercise amount and the received capacity exercise acknowledgment includes an acknowledgment amount.

Figure 33B depicts a detail flowchart of operation 5022 of Figure 4 for managing the user resource.

Arrow 8370 directs the flow of execution from starting operation 5022 to operation 8372. Operation 8372 performs determining if the exercise amount
is greater than the acknowledgment amount. Arrow 8374 directs execution
103
from operation 8372 to operation 8376. Operation 8376 terminates the

operations of this flowchart.

Arrow 8380 directs the flow of execution from starting operation 5022 to operation 8382. O' eration 8382 performs reporting a shortfall of the exercise
p
amount minus the acknowledgment amount whenever the exercise amount is greater than the acknowledgment amount. Arrow 8384 directs execution from operation 8382 to operation 8376. Operation 8376 terminates the operations of this flowchart.

Note that a market trade may be associated with at least one of said market io intervals of said fungible, ephemeral commodity by said certified client with a member of the trade specification collection.

A trade specification collection may include a bid specification, an ask specification and a commitment specification. Each of these specifications may include an amount and price.
Additionally any of these' specifications may refer to a capacity option which
A commitment specification may further include references to one or more other certified clients participating in the commitment.

Figure 34A depicts a detail flowchart of operation 5052 of Figure 4 for managing said market trade collection.

Arrow 8410 directs the flow of execution from starting operation 5052 to operation 8412. Operation 8412 performs presenting said market trade, for at least one of said market trades. Arrow 8414 directs execution from operation
104
to operation 8416. Operation 8416 terminates the operations of this flowchart.

Figure 34B depicts a detail flowchart of operation 8412 of Figure 34A for presenting said market trade, for at least one of said market trades.

Arrow 8450 directs the flow of execution from starting operation 8412 to operation 8452. Operation 8452 performs presenting said market interval. Arrow 8454 directs execution from operation 8452 to operation 8456.

Operation 8456 terminates the operations of this flowchart.

Arrow 8460 directs the flow of execution from starting operation 8412 to lo operation 8462. Operation 8462 performs identifying said member of said trade specification collection, Arrow 8464 directs execution from operation
8462 to operation 8456. Operation 8456 terminates the operations of this f lowchart.

Note that identifying the trade specification collection member may be i5 achieved by at least any of the following: a visual token or icon located near the presentation of the trade; a columnar region in which all the market trades for that specification member are listed; and a color coding of a market trade based upon the specification collection membership.

Arrow 8470 directs the flow of execution from starting operation 8412 to operation 8472. Operation 8472 performs presenting said amount. Arrow 8474 directs execution from operation 8472 to operation 8456. Operation

8456 terminates the operations of this flowchart.
105
Arrow 8480 directs the flow of execution from starting operation 8412 to operation 8482. Operation 8482 performs presenting said price. Arrow 8484 directs execution from operation 8482 to operation 8456. Operation 8456 terminates the operations of this flowchart.

Note that as used herein, presentation of a market trade to a certified client, who is a software agent, may include the operations of Figure 34B asserting facts to the software agent.

In many circumstances, the identification of other certified clients involved in
at least the commitment trades can be expected, even though this may not io always be the case.

Consider a collective trading situation of a group of small facility operators pooling their resources to trade in a general market such as the virtual trading floor. Such small operators may be unable to individually participate in the general market, due to minimum lot size constraints. In such situations, the individual certified client may not be informed of other trading certified clients, just of the open bids and asks as well as commitments within their collective group.
The preceding embodiments of the invention have been provided by way of example and are not meant to constrain the scope of the following Claims.

Claim
A transaction system supporting transactions involving at least one fungible, ephemeral commodity, comprising:
a computer communicatively coupled to a certified client, and
accessibly coupled to a computer memory, and controlled by a program system comprised of program steps residing in said memory of:
said certified client initiating at least one action in said transaction system; and further comprising at least two members of the basic usage lo program collection comprising program steps of:
managing at least one user resources;
managing a bilateral trading portfolio comprising at least one bilateral trade in at least one of said fungible, ephemeral commodities;
managing a market position portfolio comprising market positions of at least one of said fungible, ephemeral commodities;
managing a market trading collection comprising at least one market trade in at least one of said fungible, ephemeral commodities;
managing a credit resource collection comprising at least one credit resource; and
managing compliance reporting based upon at least one member of the collection comprising said user resources, said market position portfolio,
said bilateral trading portfolio. and said market trading collection;
wherein the program step of said certified client initiating said action in said transaction system is further comprised of at least one member of the
collection comprising the program steps of:
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initiating a bid for a market interval at a bid price and a bid amount as a
first validated order;
initiating an ask for a market interval at a ask price and a ask amount as a second validated order;
responding to a financial commitment presented by said transaction system to create a financial response to said financial commitment;

.reporting at least one of said bilateral trades to said transaction system;
and
confirming at least one of said bilateral trades to said transaction system;
wherein said market interval includes a product type associated with at least one of said fungible, ephemeral commodities for at least one location for
at least one time interval; and
wherein the program step of said certified client responding to said financial commitment presented by said transaction system is further comprised of at least one member of the collection comprising the program steps of
creating a financial payment of said financial commitment in said transaction system; and
creating a financial counter-response to said financial commitment in said transaction system.

2 The system of Claim 1;
wherein the program step of managing said user resource further comprises at least one member of the collection comprising the program steps of:
108
managing a generator of at least one of said fungible, ephemeral commodities;
managing a load consuming at least one of said fungible, ephemeral commodities;
managing a transmission facility for at least one of said fungible, ephemeral commodities;
managing an import providing at least one of said fungible, ephemeral commodities; and
managing an export consuming at least one of said fungible,
lo ephemeral commodities.

3 The system of Claim 2,
wherein the program step managing said user resource is further comprised of the program step of:
creating a first knowledge interval of said ephemeral, fungible commodity at a first time interval containing a first cost in said knowledge
interval collection; and further comprised of at least one member of the collection comprising the program steps of:
maintaining a bid interval collection of bid intervals of said ephemeral, fungible commodity, each comprised of a bid price, a bid amount, and a bid
time interval; and
maintaining an ask interval collection of ask intervals of said ephemeral, fungible commodity, each comprised of a ask price, a ask amount,
and a ask time interval;
wherein the program step creating said first knowledge interval is comprised of the program steps of:
109
receiving a knowledge interval creation message to create a received knowledge interval creation message; and
creating said first knowledge interval of said ephemeral, fungible commodity at said first time interval containing said first cost in said knowledge interval collection based upon said received knowledge interval creation message.

4 The system of Claim 3,
wherein the program step managing said user resource is further
lo comprised of the program steps of:
determining said ephemeral, fungible commodity needs over a
planning time interval; and
determining an equipment usage plan based upon said knowledge
interval collection containing an equipment usage item of said user
resource comprised of an activation time and an action belonging to an
action collection comprising start-action, stop-action and
throttle-action to create a resource
operating schedule; and
operating said equipment usage item of said user resource based upon
said device operating schedule.
5 The system of Claim 4,
wherein the program step managing said user resource is further
comprised of the program step of:
examining an equipment usage collection comprised of equipment
usage entries each containing a delivery time and a need schedule for
said
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ephemeral, fungible commodity to create said ephemeral, fungible
commodity needs over said planning time interval comprises an amount.

6 The system of Claim 5,
wherein said ephemeral, fungible commodity needs over said planning
time interval further comprises a cost limit; and
wherein the program step initiating said bid is further comprised of the
program step of:
making said bid of a first bid amount at a first bid price within said
cost io limit for said first time interval of said ephemeral, fungible
commodity.

7 The system of Claim 4,
wherein the program step operating said equipment usage item based
upon said device operating schedule is further comprised of at least one
member of the collection comprising the program steps of
starting said equipment usage item of said user resource;
stopping said equipment usage item of said user resource; and
throttling said equipment usage item of said user resource.
2o 8. The system of Claim 1 1
wherein the program step of managing.said market position portfolio is
comprised of the program steps of:
maintaining a market window;
maintaining a local market position portfolio comprised of at least one
market position summary, each of said market position summaries including
a
ill
market interval of said fungible, ephemeral commodity within said market
window;
presenting said local market position portfolio based upon said market
window;
wherein the program step of presenting said local market position
portfolio is further comprised of:
presenting at least one of said market position summaries including
said market interval within said market window.
lo 9. The system of Claim 8,
wherein at least one of said market position summaries of said local
market position portfolio is further comprised of an amount-held, a
current bid summary, a current ask summary, a current market price and a
current order

summary;
wherein the program step of presenting said market position summary further comprising the program steps of:
presenting said included market interval;
presenting said amount-held;
presenting said current bid summary;
presenting said current ask summary;
presenting said current market price; and
presenting said current order summary.

10 The system of Claim 9,
the program system further comprising the program step of maintaining a market position database including the program step of:
112
maintaining at least one of said market positions containing at least one of said market intervals further including at least one member of the collection comprising the program steps of:
maintaining an amount-held associated with said market interval;
maintaining a current bid list associated with said market interval including at least one current bid;
maintaining a current ask list associated with said market interval including at least one ask;
maintaining a current market price associated with said market interval; and
maintaining a current order list associated with said market interval.

11 The system of Claim 1 01
wherein the program system further comprises the program step of:
establishing a client node belonging to said node collection of said AC power network as said business location; and
wherein the program step of maintaining said local market position portfolio is further comprised of at least one member of a calculation collection
comprising the program steps of:
calculating said current bid summary from said market position database based upon said business location;
calculating said current ask summary from said market position database based upon said business location; and
113
calculating said current market price from said market position database based upon said business location.

12 The system of Claim 1 1,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and contains
said location as a first of said nodes directed to a second of said nodes of said AC power network node collection.
io 13. The system of Claim 12,
wherein the program system further comprises the program step of:
maintaining a flowgate collection containing at least two flowgate entries;
wherein each of said flowgate entries contained in said flowgate collection includes a factor, a from-node of said nodecollection and a to-node
of said node collection;
wherein for each of said flowgate entries contained in said flowgate collection, at least one of said market intervals contains said AC **power**

transfer product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry; and
wherein at least one member of said calculation collection is further based upon said flowgate collection.

14 The system of Claim 13,
wherein said product type is further comprised of an AC **power transfer** point-to-point product type as said fungible, ephemeral commodity.
114
. The system of Claim 14,
wherein the program step maintaining said current bid list is further comprised of the program steps of:
receiving a request for a point-to-point bid associated with said market interval to create a received point-to-point bid request;
generating a point-to-point bid associated with said market interval based upon said received bid request to create a new point-to-point bid associated with said market interval further including the program steps of:
generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate entry contained in said flowgate collection; and
sending said new point-to-point bid associated with said market interval based upon said received bid request as an order message.

16 The system of Claim 8,
wherein said market trade is associated with at least one of said market intervals of said fungible, ephemeral commodity by said certified client
with a member of the trade specification collection;
wherein said trade specification collection is comprised of
a bid specification containing an amount, and a price;
an ask specification containing said amount, and said price; and
an **contract** specification containing said amount and said price;
wherein the program step managing said market trade collection is further comprised of the program step of
115
presenting said market trade, for at least one of said market trades, further comprised of the program steps of
presenting said market interval;
identifying said member of'said trade specification collection;
presenting said amount; and
presenting said price.
17 The system of Claim 1 1
wherein the program step of managing said bilateral trading portfolio is io further comprised of the program steps of:
managing said bilateral trade, for each of said bilateral trades of said bilateral trading portfolio.

18 The system of Claim 1,
wherein the program step of managing said bilateral trading portfolio is further comprised of the program steps of:
receiving an authenticated bilateral trade notification message to create a received bilateral trade-notification message;
updating said bilateral trading portfolio based upon said received
2o bilateral trade notification message;
generating an initial bilateral trade;

processing said initial bilateral trade to create an initial bilateral trade
message;
inserting said initial bilateral trade into said bilateral trading portfolio;
sending said initial bilateral trade message;
116
receiving a bilateral trade confirmation message to create a received bilateral trade Confirmation request; and
inserting said received bilateral trade confirmation request into said bilateral trading portfolio.

19 The system of Claim 18,
wherein the program step of managing said bilateral trading,portfolio is further comprised of the program steps of:
responding to said received bilateral trade confirmation request to io create a bilateral trade confirmation response;
inserting said bilateral trade confirmation response into said bilateral trading portfolio;
processing said bilateral trade confirmation response to create a bilateral trade confirmation response message; and
sending said bilateral trade confirmation response message.

20 The system of Claim 1 1
wherein the program step of managing said credit resource collection is comprised of the program steps of:
managing said credit resource, for each of said credit resources of said credit resource collection.

21 The system of Claim 20,
wherein the program step of managing said credit resource, for at least one of said credit resources of said credit resource collection, is further
comprised of the program steps of:
117
receiving a credit resource message from said transaction system to create a received credit resource message;
updating said credit resource based upon said received credit resource message;
presenting said credit resource;
preparing a credit resource request message; and
sending said credit resource request message to create a sent credit request.
lo 22. The system of Claim 21
wherein the program step of receiving said credit resource message is further comprised of the program step of:
receiving a credit request response message from said transaction system based upon said sent credit request to create a received credit request response.

23 The system of Claim 1
wherein the program step of managing said user resource, is further comprised of the program steps of:
receiving a user resource schedule including a time interval from said transaction system to create a received schedule for said time interval;
updating an operating schedule for said user resource based upon said received schedule for said time interval to create said operating schedule
containing an operating schedule entry for said time interval;
maintaining a real-time; and

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controlling said user resource based upon said operating schedule for said user resource and based upon said real-time.

24 The system of Claim 23,
wherein said operating schedule entry for said time interval contained in said operating schedule for said user resource includes a capacity option
item; and
wherein the program step of managing said user resource is further comprised of the program steps of:
sending a capacity option exercise message for said time interval based said capacity option item to create a sent capacity option exercise; and
updating said operating schedule entry for said time interval based upon said sent capacity option exercise.

25 The system of Claim 24,
wherein the program step of managing said user resource is further comprised of the program steps of:
receiving a capacity exercise acknowledgment based upon said sent capacity option exercise to create a received capacity exercise
2o acknowledgment; and
updating said operating schedule entry for said time interval based upon said received capacity exercise acknowledgment.

26 The system of Claim 25,
wherein said sent capacity option exercise includes an exercise amount;
119
wherein said received capacity exercise acknowledgment includes an acknowledgment amount;
wherein the program step of managing said user resource is further comprised of the program steps of:
determining if said exercise amount is greater than said acknowledgment amount, and
reporting a shortfall of said exercise amount minus said acknowledgment amount whenever said exercise amount is greater than said acknowledgment amount.

27 The system of Claim 1,
wherein said program system supports said certified client acoustically communicating with said computer to interactively use said transaction system.

28 The system of Claim 1 , further comprising
a client computer communicatively coupled to a server computer included in a server system;
wherein said certified client operates said client computer to interactively use said transaction system.

29 The system of Claim 28,
wherein said server system provides a market engine supporting a virtual trading floor involving said fungible, ephemeral commodities.

30 The system of Claim 29,
120
wherein said server system further comprises an engine system supporting said virtual trading floor involving said fungible, ephemeral commodities.

31 A method for a certified client interactively using a transaction system supporting transactions involving at least one fungible, ephemeral commodity,
comprising the step of:
said certified client initiating at least one action in said transaction system;
and further comprising at least two members of the basic usage collection comprising the steps of:
managing at least one user resource;
managing a bilateral trading portfolio comprising at least one bilateral trade in at least one of said fungible, ephemeral commodities;
managing a market position portfolio comprising at least one market position of at least one of said fungible, ephemeral commodities;
managing a market trading collection comprising at least one market trade in at least one of said fungible, ephemeral commodities;
managing a credit resource collection comprising at least one credit
2o resource; and
managing compliance reporting based upon at least one member of the collection comprising said user resources, said market position portfolio,
said bilateral trading portfolio and said market trading collection;
wherein the step of said certified client initiating said action in said transaction system is further comprised of at least one member of the collection comprising the steps of:
121
initiating a bid for a market interval at a bid price and a bid amount as a
first validated order;
initiating an ask for a market interval at a ask price and a ask amount as a second validated order;
responding to a financial commitment presented by said transaction system to create a financial response to said financial commitment;
reporting at least one of said bilateral trades to said transaction system;
and
confirming at least one of said bilateral trades to said transaction
lo system;
wherein said market interval includes a product type associated with at least one of said fungible, ephemeral commodities for at least one location for
at least one time interval; and
wherein the step of'responding to said financial commitment presented by said transaction system is further comprised of at least one member of the
collection comprising the steps of
creating a financial payment of said financial commitment; and
creating a financial counter-response to said financial commitment.
2o 32. The method of Claim 31,
wherein the step of managing said user resource further comprises at least one member of the collection comprising the steps of:
managing a generator of at least one of said fungible, ephemeral commodities; '
managing a load consuming at least one of said fungible, ephemeral commodities;
122
managing a transmission facility for at least one of said fungible, ephemeral commodities;
managing an import providing at least one of said fungible, ephemeral commodities; and

managing an export consuming at least one of said fungible, ephemeral commodities.

33 The method of Claim 32,
wherein the step managing said user resource is further comprised of lo the step of:
creating a first knowledge interval of said ephemeral, fungible commodity at a first time interval containing a first cost in said khowledge
interval collection;
wherein the step managing said user resource is further comprised of at least one member of the collection comprising the steps of:
maintaining a bid interval collection of bid intervals of said ephemeral, fungible commodity, each comprised of a bid price, a bid amount, and a bid
time interval; and
maintaining an ask interval collection of ask intervals of said ephemeral, fungible commodity, each comprised of a ask price, a ask amount,
and a ask time interval;
wherein the step creating said first knowledge interval is comprised of the steps of:
receiving a knowledge interval creation message to create a received knowledge interval creation message; and
123
creating said first knowledge interval of said ephemeral, fungible commodity at said first time interval containing said first cost in said knowledge interval collection'based upon said received knowledge interval creation message.

34 The method of Claim 33,
wherein the step managing said user resource is further comprised of the steps of:
determining said ephemeral, fungible commodity needs over a
io planning time interval; and
determining an equipment usage plan based upon said knowledge interval collection containing an equipment usage item of said user resource comprised of an activation time and an action belonging to an action collection comprising start-action, stop-action and throttle-action to create a resource
operating schedule; and
operating said equipment usage item of said user resource based upon said device operating schedule.

35 The method of Claim 34,
wherein the step managing said user resource is further comprised of the step of:
examining an equipment usage collection comprised of equipment usage entries each containing a delivery time and a need schedule for said ephemeral, fungible commodity to create said ephemeral, fungible commodity needs over said planning time interval comprises an amount.
124
. The method of Claim 35
wherein said ephemeral, fungible commodity needs over said planning time interval further comprises a cost limit; and
wherein the step initiating said bid is further comprised of the step of:
making said bid of a first bid amount at a first bid price within said cost limit for said first time interval of said ephemeral, fungible commodity.

37 The method of Claim 34,
wherein the step operating said equipment usage item based upon
lo said device operating schedule is further comprised of at least one member of
the collection comprising the steps of
starting said equipment usage item of said user resource;
stopping said equipment usage item of said user resource; and
throttling said equipment usage item of said user resource.

38 The method of Claim 31,
wherein the step of managing said market position portfolio is comprised of the steps of:
maintaining a market window;
maintaining a local market position portfolio comprised of at least one market position summary, each of said market position summaries including a
market interval of said fungible, ephemeral commodity within said market window;
presenting said local market position portfolio based upon said market window;
125
wherein the step of presenting said local market position portfolio is further comprised of
presenting at least one of said market position summaries including said market interval within said market window.

39 The method of Claim 38,
wherein at least one of said market position summaries of said local market position portfolio is further comprised of an amount-held, a current bid summary, a current ask summary, a current market price and a current order
lo summary;
wherein the step of presenting said market position summary further comprising the steps of
presenting said included market interval;
presenting said amount-held;
presenting said current bid summary;
presenting said current ask summary;
presenting said current market price; and
presenting said current order summary.
2o 40. The method of Claim 39, further comprising the step of:
maintaining a market position database including the step of
maintaining at least one of- said market positions containing at least one of said market intervals further including at least one member of the collection comprising the steps of
maintaining an amount-held associated with said market interval;
126
maintaining a current bid list associated with said market interval including at least one current bid;
maintaining a current ask list associated with said market interval including at least one ask;
maintaining a current market price associated with said market interval; and
maintaining a current order list associated with said market interval.
io 41. The method of Claim 40, further comprising the step of:
establishing a client node belonging to said node collection of said AC power network as said business location; and
wherein the step maintaining said local market position portfolio is

further comprised of at least one member of a calculation collection
15 ' comprising the steps of:
calculating said current bid summary from said market position
database based upon said business location;
calculating said current ask summary from said market position
database based upon said business location; and
calculating said current market price from said market position
database based upon said business location.

42 The method of Claim 41,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and
contains
127
said location as a first of said nodes directed to a second of said nodes
of said AC power network node collection.
43 The method of Claim 42, further comprising the step of:
maintaining a flowgate collection containing at least two flowgate
entries;
wherein each of said flowgate entries contained in said flowgate
collection includes a factor, a from-node of said node collection and a
to-node
of said node collection;
wherein for each of said flowgate entries contained in said flowgate
collection, at least one of said market intervals contains said AC
power transfer product type as said fungible, ephemeral commodity and said
location
coinciding with said flowgate entry; and
wherein at least one member of said calculation collection is further
based upon said flowgate collection.

44 The method of Claim 43,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.

45 The method of Claim 44,
wherein the step maintaining said current bid list is further comprised
of
the steps of:
receiving a request for a point-to-point bid associated with said market
interval to create a received point-to-point bid request;
128
generating a point-to-point bid associated with said market interval
based upon said received bid request to create a new 'point-to-point bid
associated with said market interval further including the steps of:
generating a bid associated with said market interval containing said
AC **power transfer** product type and said location coinciding with said
flowgate entry, for at least one flowgate entry contained in said
flowgate collection; and
sending said new point-to-point bid associated with said market interval
based upon said received bid request as an order message.
io 46. The method of Claim 38,
wherein said market trade is associated with at least one of said
market intervals of said fungible, ephemeral commodity by said certified
client
with a member of the trade specification collection;
wherein said trade specification collection is comprised of
a bid specification containing an amount, and a price;

an ask specification containing said amount, and said price; and
an order specification containing said amount and said price;
wherein the step managing said market trade collection is further comprised of the step of
presenting said market trade, for at least one of said market trades, further comprised of the steps of
presenting said market interval;
identifying said member of said trade specification collection;
presenting said amount; and
presenting said price.
129
. The method of Claim 31,
wherein the step of managing said bilateral trading portfolio is further comprised of the steps of:
managing said bilateral trade, for each of said bilateral trades of said bilateral trading portfolio.

48 The method of Claim 31,
wherein the step of managing said bilateral trading portfolio is further comprised of the steps of:
receiving an authenticated bilateral trade notification message to create a received bilateral trade notification message;
updating said bilateral trading portfolio based upon said received bilateral trade notification message;
generating an initial bilateral trade;
processing said initial bilateral trade to create an initial bilateral trade
message;
inserting said initial bilateral trade into said bilateral trading portfolio;
sending said initial bilateral trade message;
receiving a bilateral trade confirmation message to create a received
2o bilateral trade confirmation request; and
inserting said received bilateral trade confirmation request into said bilateral trading portfolio.

49 The method of Claim 48,
wherein the step of managing said bilateral trading portfolio is further comprised of the steps of:
130
responding to said received bilateral trade confirmation request to create a bilateral trade confirmation response;
inserting said bilateral trade confirmation response into said bilateral trading portfolio;
processing said bilateral trade confirmation response to create a bilateral trade confirmation response message; and
sending said bilateral trade confirmation response message.

50 The method of Claim 31,
wherein the step of managing said credit resource collection is comprised of the steps of:
managing said credit resource, for each of said credit resources of said credit resource collection.

51 The method of Claim 50,
wherein the step of managing said credit resource, for at least one of said credit resources of said credit resource collection, is further comprised of
the steps of:
receiving a credit resource message to create a received credit

2o resource message;
updating said credit resource based upon said received credit resource message;
presenting said credit resource;
preparing a credit resource request, message; and
sending said credit resource request message to create a sent credit request.
131
. The method of Claim 51,
wherein the step of receiving said credit resource message is further comprised of the step of:
receiving a credit request response message based upon said sent credit request to create a received credit request response.

53 The method of Claim 31,
wherein the step of managing said user resource, is further comprised io of the steps of:
receiving a user resource schedule including a time interval to create a received schedule for said time interval;
updating an operating schedule for said user resource based upon said received schedule for said time interval to create said operating schedule
containing an operating schedule entry for said time interval;
maintaining a real-time; and
controlling said user resource based upon said operating schedule for said user resource and based upon said real-time.
2o 54. The method of Claim 53,
wherein said operating schedule entry for said time interval contained in said operating schedule for said user resource includes a capacity option
item; and
wherein the step of managing said user resource is further comprised of the steps of:
132
sending a capacity option exercise message for said time interval based said capacity option item to create a sent capacity option exercise; and
updating said operating schedule entry for said time interval based upon said sent capacity option exercise.

55 The method of Claim 54,
wherein the step of managing said user resource is further comprised of the steps of:
receiving a capacity exercise acknowledgment based upon said sent io capacity option exercise to create a received capacity exercise acknowledgment; and
updating said operating schedule entry for said time interval based upon said received capacity exercise acknowledgment.

56 The method of Claim 55,
wherein said sent capacity option exercise includes an exercise amount;
wherein said received capacity exercise acknowledgment includes an acknowledgment amount;
wherein the step of managing said user resource is further comprised of the steps of:
determining if said exercise amount is greater than said acknowledgment amount, and
reporting a shortfall of said exercise - amount minus said acknowledgment amount whenever said exercise amount is greater than said

acknowledgment amount.
133
. The method of Claim 31,
wherein said certified client acoustically communicates with said transaction system to interactively use said transaction system.

58 The method of Claim 31
wherein said transaction system is comprised of a client computer communicatively coupled to a server computer included in a server system;
wherein said certified client operates said client computer to
io interactively use said transaction system.
59 The method of Claim 58,
wherein said server system provides a market engine supporting a virtual trading floor involving at least one of said fungible, ephemeral commodities.

60 The method of Claim 59,
wherein said server system further comprises an engine system supporting said virtual trading floor involving said fungible, ephemeral commodities.

61 The method of Claim 58,
wherein said client computer is controlled by a program system containing program steps residing in a memory accessibly coupled to said client computer;
134
wherein said program system is comprised of at least two members each implementing a member of said basic usage collection.

62 The method of Claim 31,
wherein said financial commitment in said transaction system is further comprised of a first financial obligation to a first party;
wherein the step of said certified client responding to said financial commitment. is further comprised of the step of
said certified client responding to said first financial obligation to said lo first party to create a first financial payment to said first party.

63 The first financial payment to said first party as a product of the process of Claim 62.

64 A transaction system for supporting transactions involving at least one
fungible, ephemeral commodity, comprising:
a means for using said transaction system communicatively coupled to a certified client comprising
a means for said certified client initiating at least one action in said transaction system; and further comprised of at least two members of the basic usage means collection comprising of:
a means for managing at least one user resources;
a means for managing a bilateral trading portfolio comprising at least one bilateral trade in at least one of said fungible, ephemeral commodities;
a means for managing a market position portfolio comprising market positions of at least one of said fungible, ephemeral commodities;
135
a means for managing a market trading collection comprising'at least one market trade in at least one of said fungible, ephemeral commodities;
a means for managing a credit resource collection comprising at least one credit resource; and

a means for managing compliance reporting based upon at least one member of the collection comprising said user resources, said market position portfolio, said bilateral trading portfolio and said market trading collection; wherein said means for said certified client initiating said action in said
transaction system is further comprised of at least one member of the lo collection comprising:
a means for initiating a bid for a market interval at a bid price and a bid
amount, as a first validated order;
a means for a first ask for a market interval at a ask price and alask amount as a second validated order;
a means for responding to a financial commitment presented by said transaction system to create a financial response to said financial commitment;
a means for reporting at least one of said bilateral trades to said transaction system; and
a means for confirming at least one of said bilateral trades to said transaction system;
wherein said market interval includes a product type associated with at least one of -said fungible, ephemeral commodities for at least one location for
at least one time interval; and
136
wherein said means for responding to said financial commitment presented by said transaction system is further comprised of at least one member of the collection comprising
means for creating a financial payment of said financial commitment; and
means for said certified client creating a financial counter-response to said financial commitment.

65 The system of Claim 64,
wherein said means for managing said user resource further comprises at least one member of the collection comprising:
a means for managing a generator of at least one of said fungible, ephemeral commodities;
a means for managing a load consuming at least one of said fungible, ephemeral commodities;
a means for managing a transmission facility for at least one of said fungible, ephemeral commodities;
a means for managing an import providing at least one of said fungible, ephemeral commodities; and
a means for managing an export consuming at least one of said fungible, ephemeral commodities.

66 The system of Claim 65,
wherein said means for managing said user resource is further comprised of:
137
a means for creating a first knowledge interval of said ephemeral, fungible commodity at a first time interval containing a first cost in said
knowledge interval collection;
wherein said means for managing said user resource is further comprised of at least one member of the collection comprising:
a means for maintaining a bid interval collection of bid intervals of said ephemeral, fungible commodity, each comprised of a bid price, a bid amount,
and a bid time interval; and

a means for maintaining an ask interval collection of ask intervals of lo said ephemeral, fungible commodity, each comprised of a ask price, a ask
amount, and a ask time interval;
wherein said means for creating said first knowledge interval is comprised of:
a means for receiving a knowledge interval creation message to create a received knowledge interval creation message; and
a means for creating said first knowledge interval of said ephemeral, fungible commodity at said first time interval containing said first cost in said knowledge interval collection based upon said received knowledge interval creation message.

67 The system of Claim 66,
wherein said means for managing said user resource is further comprised of:
a means for determining said ephemeral, fungible commodity needs over a planning time interval; and
138
a means for determining an equipment usage plan based upon said knowledge interval collection containing an equipment usage item of said user resource comprised of an activation time and an action belonging to an action collection comprising start-action, stop-action and throttle-action to create a
resource operating schedule; and
a means for operating said equipment usage item of said user resource based upon said device operating schedule.

68 The system of Claim of 67,
wherein said means for managing said user resource is further comprised of:
a means for examining an equipment usage collection comprised of equipment usage entries each containing a delivery time and a need schedule for said ephemeral, fungible commodity to create said ephemeral,.fungible commodity needs over said planning time interval comprises an amount.

69 The system of Claim of 68,
wherein said ephemeral, fungible commodity needs over said planning time interval further comprises a cost limit; and
wherein said means for initiating said bid is further comprised of:
a means for making said bid of a first bid amount at a first bid price within said cost limit for said first time interval of said ephemeral, fungible
commodity. ,
70 The system of Claim 67,
139
wherein said means for operating said equipment usage item based upon said device operating schedule is further comprised of at least one member of the collection comprising
a means for starting said equipment usage item of said user resource;
a means for stopping said equipment usage item of said user resource; and
a means for throttling said equipment usage item of said user resource.

71 The system of Claim 64,
wherein said means for managing said market position portfolio is comprised of:
a means for maintaining a market window;
a means for maintaining a local market position portfolio comprised of

at least one market position summary, each of said market position summaries including a market interval of said fungible, ephemeral commodity
within said market window;
a means for presenting said local market position portfolio based upon said market window;
wherein said means for presenting said local market position portfolio is further comprised of:
a means for presenting at least one of said market position summaries including said market interval within said market window.

72 The system of Claim 71,
wherein at least one of said market position summaries of said local market position portfolio is further comprised of an amount-held, a current bid
140
summary, a current ask summary, a current market price and a current order
summary;
wherein said means for presenting said market position summary further comprising:
a means for presenting said included market interval;
a means for presenting said amount-held;
a means for presenting said current bid summary;
a means for presenting said current ask summary;
a means for presenting said current market price; and
a means for presenting said current order summary.

73 The system of Claim 72, further comprising
a means for maintaining a market position database including:
a means for maintaining at least one of said market positions containing at least one of said market intervals further including at least
one member of the collection comprising:
a means for maintaining an amount-held associated with said market interval;
a means for maintaining a current bid list associated with said market interval including at least one current bid;
a means for maintaining a current ask list associated with said market interval including at least one ask;
a means for maintaining a current market price associated with said market interval; and
a means for maintaining a current order list associated with said market interval.
141
. The system of Claim 73, further comprising:
a means for establishing a client node belonging to said node collection of said AC power network as said business location; and
wherein said means for maintaining said local market position portfolio is further comprised of at least one member of a calculation collection comprising:
a means for calculating said current bid summary from said market position database based upon said business location;
a means for calculating said current ask summary from said market position database based upon said business location; and
a means for calculating said current market price from said market position database based upon said business location.

75 The system of Claim 74,
wherein at least one of said market intervals contains an AC **power**

transfer product type as said fungible, ephemeral commodity and contains
said location as a first of said nodes directed to a second of said nodes of said AC power network node collection.

76 The system of Claim 75, further comprising:
a means for maintaining a flowgate collection containing at least two flowgate entries;
wherein each of said flowgate entries contained in said flowgate collection includes a factor, a from-node of said node collection and a to- node
of said node collection;
142
wherein for each of said flowgate entries contained in said flowgate collection, at least one of said market intervals contains said AC **power**

transfer product type as said fungible, ephemeral commodity and said location
coinciding with said fiowgate entry; and
wherein at least one member of said calculation collection is further based upon said flowgate collection.

77 The system of Claim 76,
wherein said product type is further comprised of an AC **power** **transfer**

io point-to-point product type as said fungible, ephemeral commodity.

78 The system of Claim 77,
wherein said means for maintaining said current bid list is further comprised of:
a means for receiving a request for a point-to-point bid associated with said market interval to create a received point-to-point bid request;
a means for generating a point-to-point bid associated with said market interval based upon said received bid request to create a new point-to-point
bid associated with said market interval further including:
a means for generating a bid associated with said market interval containing said AC **power** **transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate entry contained in said
flowgate collection; and
a means for sending said new point-to-point bid associated with said market interval based upon said received bid request as an order message.
143
. The system of Claim 71,
wherein said market trade is associated with at least one of said market intervals of said fungible, ephemeral commodity by said certified client
with a member of the trade specification collection;
wherein said trade specification collection is comprised of
a bid specification containing an amount, and a price;
an ask specification containing said amount, and said price; and
an order specification containing said amount and said price;
wherein said means for managing said market trade collection is
lo further comprised of
a means for presenting said market trade, for at least one of said market trades, further comprised of
a means for presenting sa id market interval;
a means for identifying said member of said trade specification collection;

a means for presenting said amount; and
a means for presenting said price.

80 The system of Claim 64,
wherein said means for managing said bilateral trading portfolio is ..... further comprised of:
a means for managing said bilateral trade, for each of said bilateral trades of said bilateral trading portfolio.

81 The system of Claim 64,
144
wherein said means for managing said bilateral trading portfolio is further comprised of:
a means for receiving an authenticated bilateral trade notification message to create a received bilateral trade notification message; and
a means for updating said bilateral trading portfolio based upon said received bilateral trade notification message;
means for generating an initial bilateral trade;
means for processing said initial bilateral trade to create an initial bilateral trade message;
a means for inserting said initial bilateral trade into said bilateral trading
portfolio; and
a means for sending said initial bilateral trade message;
a means for receiving a bilateral trade confirmation message to create a received bilateral trade confirmation request; and
a means for inserting said received bilateral trade confirmation request into said bilateral trading portfolio.

82 The system of Claim 81,
wherein said means for managing said bilateral trading portfolio is further comprised of:
a means for responding to said received bilateral trade confirmation request to create a bilateral trade confirmation response;
a means for inserting said bilateral trade confirmation response into said bilateral trading portfolio;
a means for processing said bilateral trade confirmation response to create a bilateral trade confirmation response message; and
145
a means for sending said bilateral trade confirmation response message.
83 The system of Claim 64,
wherein said means for managing said credit resource collection is comprised of:
a means for managing said credit resource, for each of said credit resources of said credit resource collection.
lo 84. The system of Claim 83,
wherein said means for managing said credit resource, for at least one of said credit resources of said credit resource collection, is further comprised
of:
a means for receiving a credit resource message from said transaction system to create a received credit resource message;
a means for updating said credit resource based upon said received credit resource message;
a means for presenting said credit resource;
a means for preparing a credit resource request message; and
a means for sending said credit resource request message to create a sent credit request.

85 The system of Claim 84,
wherein said means for receiving said credit resource message is further comprised of:
146
a means for receiving a credit request response message from said transaction system based upon said sent credit request to create a received credit request response.

86 The system of Claim 64,
wherein said means for managing said user resource, is further comprised of:
a means for receiving a user resource schedule including a time interval from said transaction system to create a received schedule for said
lo time interval;
a means for updating an operating schedule for said 'user resource based upon said received schedule for said time interval to create said operating schedule containing an operating schedule entry for said time interval;
a means for maintaining a real-time; and
a means for controlling said user resource based upon said operating schedule for said user resource and based upon said real-time.

87 The system of Claim 86,
wherein said operating schedule entry for said time interval contained in said operating schedule@ for said user resource includes a capacity option
item; and
wherein said means for managing said user resource is further comprised of:
147
a means for sending a capacity option exercise message for said time interval based said capacity option item to create a sent capacity option exercise; and
a means for updating said operating schedule entry for said time interval based upon said sent capacity option exercise.

88 The system of Claim 87,
wherein said means for managing said user resource is further comprised of:
a means for receiving a capacity exercise acknowledgment based upon said sent capacity option exercise to create a received capacity exercise
acknowledgment; and
a means for updating said operating schedule entry for said time interval based upon said received capacity exercise acknowledgment.
89 The system of Claim 88,
wherein said sent capacity option exercise includes an exercise amount;
wherein said received capacity exercise acknowledgment includes an
2o acknowledgment amount;
wherein said means for managing said user resource is further comprised of:
a means for determining if said exercise amount is greater than said acknowledgment amount; and
148
a means for reporting a shortfall of said exercise amount minus said acknowledgment amount whenever said exercise amount is greater than said acknowledgment amount.

90 The system of Claim 64,
wherein said means'for using said transaction system supports at least one member of the collection comprising:
said certified client acoustically communicating with said transaction system to interactively use said transaction system;
said certified client communicating in a tactile fashion with said transaction system to interactively use said transaction system;
said certified client communicating in a wireless fashion with said transaction system to interactively use said transaction system; and
said certified client communicating in a wireline fashion with said transaction system to interactively use said transaction system.

91 The system of Claim 64,
wherein said transaction system is further comprised of at least one computer operated by said certified client and controlled by a program system comprised of program steps residing in a memory accessibly coupled to said computer.

92 The system of Claim 91,
wherein said means for using said transaction system is implemented as at least one of said program steps in said program system.
149
. The system of Claim 91,
wherein at least one member of said basic usage means collection is implemented as at least one of said program steps in said program system.

94 The system of Claim 64,
wherein said transaction system is further comprised of a client computer communicatively coupled to a server computer included in a server
system;
wherein said certified client operates said client computer to
lo interactively use said transaction system.

95 The system of Claim 94,
wherein said server system provides, a market engine supporting a virtual trading floor involving said fungible, ephemeral commodities.

96 The system of Claim 95,
wherein said server system further comprises an engine system supporting said virtual trading floor involving said fungible, ephemeral commodities.

97 A transaction system supporting transactions involving at least one fungible, ephemeral commodity, comprising:
a computer communicatively coupled to a certified client, and accessibly coupled to a computer memory, and controlled by a program system comprised of program steps residing in said memory of:
150
said certified client initiating at least one action in said transaction system; and is further comprised of at least two members of the basic usage
program collection comprising program steps of:
managing at least one user resource;
managing a bilateral trading portfolio comprising at least one bilateral trade in at least one of said fungible, ephemeral commodities;
managing a market position portfolio comprising market positions of at least one of said fungible, ephemeral commodities;
managing a market trading collection comprising at least one market
lo trade in at least one of said fungible, ephemeral commodities;

managing a credit resource collection comprising at least one credit resource; and
managing compliance reporting based upon at least one member of the collection comprising said user resources, said market position portfolio, said bilateral trading portfolio and said market trading collection.

98 The system of Claim 97,
wherein the program step of said certified client initiating said action in said transaction system is further comprised of at least one member of the
collection comprising the program steps of:
initiating a bid for a market interval at a bid price and a bid amount as a
first validated order;
initiating an ask for a market interval at a ask price and a ask amount as a second validated order;
responding to a financial commitment presented by said transaction system to create a financial response to said financial commitment;
151
reporting at least one of said bilateral trades to said transaction system;
and
confirming at least one of said bilateral trades to said transaction system;
wherein said market interval includes a product type associated with at least one of said fungible, ephemeral commodities for at least one location for at least one time interval.

99 The system of Claim 98,
wherein the program step of said certified client responding to said financial commitment is further comprised of at least one member of the collection comprising the program steps of
creating a financial payment of said financial commitment in said transaction system; and
creating a financial counter-response to said financial commitment in said transaction system.
1 00. The system of Claim 98,
wherein the program step of managing said user resource further comprises at least one member of the collection comprising the program steps of:
managing a generator of at. least one of said fungible, ephemeral commodities;
managing a load consuming at least one of said fungible, ephemeral commodities;
152
managing a transmission facility for at least one of said fungible, ephemeral commodities;
managing an import providing at least one of said fungible, ephemeral commodities; and
managing an export consuming at least one of said fungible, ephemeral commodities.
101. ThesystemofClaim100,
wherein the program step managing said user resource is further
lo comprised of the program step of:
creating a first knowledge interval of said ephemeral, fungible commodity at a first time interval containing a first cost in said knowledge
interval collection; and further comprised of at least one member of the collection comprising the program steps of:

maintaining a bid interval collection of bid intervals of said ephemeral, fungible commodity, each comprised of a bid price, a bid amount, and a bid
time interval; and
maintaining an ask interval collection of ask intervals of said ephemeral, fungible commodity, each comprised of a ask price, a ask amount,
2o and a ask time interval;
wherein the program step creating said first knowledge interval is comprised of the program steps of:
receiving a knowledge interval creation message to create a received knowledge interval creation message; and
creating said first knowledge interval of said ephemeral, fungible commodity at said first time interval containing said first cost in said 153
knowledge interval collection based upon said received knowledge interval creation message.
102. ThosystemofClaiml01,
wherein the program step managing said user resource is further comprised of the program steps of:
determining said ephemeral, fungible commodity needs over a planning time interval; and
determining an equipment usage plan based upon said knowledge
lo interval collection containing an equipment usage item of said user resource comprised of an activation time and an action belonging to an action collection comprising start-action, stop-action and throttle-action to create a resource
operating schedule; and
operating said equipment usage item of said user resource based upon
i5 said device operating schedule.
103. The system of Claim 102,
wherein the program step managing said user resource is further comprised of the program stop of:
examining an equipment usage collection comprised of equipment usage entries each containing a delivery time and a need schedule for said ephemeral, fungible commodity to create said ephemeral, fungible commodity needs over said planning time interval comprises an amount.
104. The system of Claim 103,
154
wherein said ephemeral, fungible commodity needs over said planning time interval further comprises a cost limit; and
wherein the program step initiating said bid is further comprised of the program step of:
making said bid of a first bid amount at a first bid price within said cost limit for said first time interval of said'ephemeral, fungible commodity.
105. The system of Claim 102,
wherein the program step operating said equipment usage item based
io upon said device operating schedule is further comprised of at least one
member of the collection comprising the program steps of
starting said equipment usage item of said user resource;
stopping said equipment usage item of said user resource; and
throttling said equipment usage item of said user resource.
106. The system of Claim 97,
wherein the program step of managing said market position portfolio is comprised of the program steps of:
maintaining a market window;
maintaining a local market position portfolio comprised of at least one market position summary, each of said.market position summaries including

a
market interval of said fungible, ephemeral commodity within said market window;
presenting said local market position portfolio based upon said market window;
155
wherein the program step of presenting said local market position portfolio is further comprised of:
presenting at least one of said market position summaries including said market interval within said market window.
107. The system of Claim 106,
wherein at least one of said market position summaries of said local market position portfolio is further comprised of an amount-held, a current bid summary, a current ask summary, a current market price and a current order
lo summary;
wherein the program step of presenting said market position summary further comprising the program steps of:
presenting said included market interval;
presenting said amount-held;
presenting said current bid summary;
presenting said current ask summary;
presenting said current market price; and
presenting said current order summary.
108. The system of Claim 107,
wherein the program system is further comprised of the program step maintaining a market position database including the program step of:
maintaining at least one of said market positions containing at least one of said market intervals further including at least one member of the collection comprising the program steps of:
156
maintaining an amount-held associated with said market interval;
maintaining a current bid list associated with said market interval including at least one current bid;
maintaining a current ask list associated with said market interval including at least one ask;
maintaining a current market price associated with said market interval; and
maintaining a current order list associated with said market interval.
109. The system of Claim 108,
wherein the program system is further comprised of the program step of:
establishing a client node belonging to said node collection of said AC power network as said business location; and
wherein the program step maintaining said local market position portfolio is further comprised of at least one member of a calculation collection
comprising the program steps of:
calculating said current bid summary from said market position database based upon said business location;
calculating said current ask summary from said market position database based upon said business location; and
calculating said current market price from said market position database based upon said business location.
157
1 0. The system of Claim 109,
wherein at least one of said market intervals contains an AC **power transfer** product type as said fungible, ephemeral commodity and

contains
said location as a first of said nodes directed to a second of said nodes
of said AC power network node collection.
1 1 1. The system of Claim 1 1 01
wherein the program system is further comprised of the program step
of:
maintaining a flowgate collection containing at least two flowgate
entries;
wherein each of said flowgate entries contained in said flowgate
collection includes a factor, a from-node of said node collection and a
to-node
of said node collection;
wherein for each of said flowgate entries contained in said flowgate
collection, at least one of said market intervals contains said AC **power**

transfer product type as said fungible, ephemeral commodity and said
location
coinciding with said flowgate entry; and
wherein at least one member of said calculation collection is further
2o based upon said flowgate collection.
112. ThesystemofClaim111,
wherein said product type is further comprised of an AC **power** **transfer**

point-to-point product type as said fungible, ephemeral commodity.
113. ThesystemofClaim112,
158
wherein the program step maintaining said current bid list is further
comprised of the program steps of:
receiving a request for a point-to-point bid associated with said market
interval to create a received point-to-point bid request;
generating a point-to-point bid associated with said market interval
based upon said received bid request to create a new point-to-point bid
associated with said market interval further including the steps of:
generating a bid associated with said market interval containing said
AC **power** **transfer** product type and said location coinciding with said
flowgate lo entry, for at least one flowgate entry contained in said
flowgate collection; and
sending said new point-to-point bid associated with said market interval
based upon said received bid request as an order message.
114. The system of Claim 106,
wherein said market trade is associated with at least one of said
market intervals of said fungible, ephemeral commodity by said certified
client
with a member of the trade specification collection;
wherein said trade specification collection is comprised of
a bid specification containing an amount, and a price;
an ask s'ecification containing said amount, and said price; and
p
an order specification containing said amount and said price;
wherein the program step managing said market trade collection is
further comprised of the program step of
presenting said market trade, for at least one of said market trades,
further comprised of the program steps of
presenting said market interval;
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identifying said member of said trade specification collection;
presenting said amount; and
presenting said price.
115. The system of Claim 97,
wherein the program step of managing said bilateral trading portfolio is

further comprised of the program steps of:
managing said bilateral trade, for each of said bilateral trades of said bilateral trading portfolio.
116. The system of Claim 97,
wherein the program step of managing said bilateral trading portfolio is further comprised of the program steps of:
receiving an authenticated bilateral trade notification message to create i5 a received bilateral trade notification message;
updating said bilateral trading portfolio based upon said received bilateral trade notification message;
generating an initial bilateral trade;
processing said initial bilateral trade to create an initial bilateral trade
message;
inserting said initial bilateral trade into said bilateral trading portfolio;
sending said initial bilateral trade message;
receiving a bilateral trade confirmation message to create a received bilateral trade confirmation request; and
inserting said received bilateral trade confirmation request into said bilateral trading portfolio.
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1 7. The system of Claim 1 1 61
wherein the program step of managing said bilateral trading portfolio is further comprised of the program steps of:
responding to said received bilateral trade confirmation request to create a bilateral trade confirmation response;
inserting said bilateral trade confirmation response into said bilateral trading portfolio;
processing said bilateral trade confirmation response to create a lo bilateral trade confirmation response message; and
sending said bilateral trade confirmation response message.
118. The system of Claim 97,
wherein the program step of managing said credit resource collection is comprised of the program steps of:
managing said credit resource, for each of said credit resources of said credit resource collection.
119. The system of Claim 118,
wherein the program step of managing said credit resource, for at least one of said credit resources of said credit resource collection, is further
comprised of the program steps of:
receiving a credit resource message from said transaction system to create a received credit resource message;
updating said credit resource based upon said received credit resource message;
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presenting said credit resource;
preparing a credit resource request message; and
sending said credit resource request message to create a sent credit request.
120. The system of Claim 1 1 91
wherein the program step of receiving said credit resource message is further comprised of the program step of:
receiving a credit request response message from said transaction io system based upon said sent credit request to create a received credit request response.
121. The system of Claim 97,
wherein the program step of managing said user resource, is further comprised of the program steps of:

receiving a user resource schedule including a time interval from said transaction system to create a received schedule for said time interval;
updating an operating schedule for said user resource based upon said received schedule for said time interval to create said operating schedule
containing an operating schedule entry for said time interval;
maintaining a real-time; and
controlling said user resource based upon said operating schedule for said user resource and based upon said real-time.
122. The system of Claim 121,
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wherein said operating schedule entry for said time interval contained in said operating schedule for said user resource includes a capacity option
item; and
wherein the program step of managing said user resource is further comprised of the program steps of:
sending a capacity option exercise message for said time interval based said capacity option item to create a sent capacity option exercise; and
updating said operating schedule entry for said time interval based upon said sent capacity option exercise.
123. The system of Claim 122,
wherein the program step of managing said user resource is further comprised of the program steps of:
receiving a capacity exercise acknowledgment based upon said sent capacity option exercise to create a received capacity exercise acknowledgment; and
updating said operating schedule entry for said time interval based upon said received capacity exercise acknowledgment.
124. The system of Claim 123,
wherein said sent capacity option exercise includes an exercise amount;
wherein said received capacity exercise acknowledgment includes an acknowledgment amount;
wherein the program step of managing said user resource is further comprised of the program steps of:
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determining if said exercise amount is greater than said acknowledgment amount; and
reporting a shortfall of said exercise amount minus said acknowledgment amount whenever said exercise amount is greater than said acknowledgment amount.
125. The system of Claim 97,
wherein said program system supports said certified client acoustically communicating with said computer to interactively use said transaction
lo system.
126. The system of Claim 97, further comprising
a client computer communicatively coupled to a server computer included in a server system;
wherein said certified client operates said client computer to interactively use said transaction system.
127. The system of Claim 126,
wherein said server system provides a market engine supporting a virtual trading floor involving said fungible, ephemeral commodities.
The system of Claim 127,
wherein said server system further comprises an engine system supporting said virtual trading floor involving said fungible, ephemeral Commodities.
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. A method for a certified client interactively using a transaction system supporting transactions involving at least one fungible, ephemeral commodity,
comprising the step of:
said certified client initiating at least one action in said transaction system;
and further comprising at least two members of the basic usage collection comprising the steps of:
managing at least one user resource;
managing a bilateral trading portfolio comprising at least one bilateral lo trade in at least one of said fungible, ephemeral commodities;
managing a market position portfolio comprising at least one market position of at least one of.said fungible, ephemeral commodities;
managing a market trading collection comprising at least one market trade in at least one of said fungible, ephemeral commodities;
managing a credit resource collection comprising at least one credit resource; and
managing compliance reporting based upon at least one member of the collection comprising said user resources, said market position portfolio, said bilateral trading portfolio and said market trading collection.
130. The method of Claim 129,
wherein the step of said certified client initiating said action in said transaction system is further comprised of at least one member of the collection.comprising the steps of:
initiating a bid for a market interval at a bid price and a bid amount as a
first validated order;
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initiating an ask for a market interval at a ask price and a ask amount as a second validated order;
responding to a financial commitment presented by said transaction system to create a financial response to said financial commitment;
reporting at least one of said bilateral trades to said transaction system;
and
confirming at least one of said bilateral trades to said transaction system;
wherein said market interval includes a product type associated with at lo least one of said fungible, ephemeral commodities for at least one location for at least one time interval.
131. The method of Claim 130,
wherein the step of managing said user resource further comprises at least one member of the collection comprising the steps of:
managing a generator of at least one of said fungible, ephemeral commodities;
managing a load consuming at least one of said fungible, ephemeral commodities;
managing a transmission facility for at least one of said fungible, ephemeral commodities;
managing an import providing at least one of said fungible, ephemeral commodities; and
managing an export consuming at least one of said fungible, ephemeral commodities.
166
. The method of Claim 131,
wherein the step managing said user resource is further comprised of the step of:
creating a first knowledge interval of said ephemeral, fungible commodity at a first time interval containing a first cost in said

knowledge
interval collection;
wherein the step managing said user resource is further comprised of at least one member of the collection comprising the steps of:
maintaining a bid interval collection of bid intervals of said ephemeral, lo fungible commodity, each comprised of a bid price, a bid amount, and a bid
time interval; and
maintaining an ask interval collection of ask intervals of said ephemeral, fungible commodity, each comprised of a ask price, a ask amount,
and a ask time interval;
wherein the step creating said first knowledge interval is comprised of the steps of:
receiving a knowledge interval creation message to create a received knowledge interval creation message; and
creating said first knowledge interval of said ephemeral, fungible commodity at said first time interval containing said first cost in said knowledge interval collection based upon said received knowledge interval creation message.
133. The method of Claim 132,
wherein the step managing said user resource is further comprised of the steps of:
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determining said ephemeral, fungible commodity needs over a planning time interval; and
determining an equipment usage plan based upon said knowledge interval collection containing an equipment usage item of said user resource comprised of an activation time and an action belonging to an action collection comprising start-action, stop-action and throttle-action to create a resource
operating schedule; and
operating said equipment usage item of said user resource based upon said device operating schedule.
134. The method of Claim 133,
wherein the step managing said user resource is further comprised of the step of:
examining an equipment usage collection comprised of equipment usage entries each containing a delivery time and a need schedule for said ephemeral, fungible commodity to create said ephemeral, fungible commodity needs over said planning time interval comprises an amount.
135. The method of Claim 134,
wherein said ephemeral, fungible commodity needs over said planning time interval further comprises a cost limit; and
wherein the step said certified client initiating said bid is further comprised of the step of:
making said bid of a first bid amount at a first bid price within said cost limit for said first time interval of said ephemeral, fungible commodity.
168
. The method of Claim 133,
wherein the step operating said equipment usage item based upon said device operating schedule is further comprised of at least one member of
the collection comprising the steps of
starting said equipment usage item of said user resource;
stopping said equipment usage item of said user resource; and
throttling said equipment usage item of said user resource.
137. The method of Claim 130,
wherein the step of responding to said financial commitment presented

by said transaction system is further comprised of at least one member of the
collection comprising the steps of
creating a financial payment of said financial commitment in said transaction system; and
creating a financial counter-response to said financial commitment in said transaction system.'
138. The method of Claim 137,
wherein said financial commitment in said transaction system is further comprised of a first financial obligation to a first party;
wherein the step of said certified client responding to said financial commitment is further comprised of the step of
said certified client responding to said first financial obligation to said first party to create a first financial payment to said first party.
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. The first financial payment to said first party as a product of the process of Claim 138.
140. The method of Claim 129,
wherein the step of managing said market position portfolio is comprised of the steps of:
maintaining a market window;
maintaining a local market position portfolio comprised of at least one market position summary, each of said market position summaries including a lo market interval of said fungible, ephemeral commodity within said market
window;
presenting said local market position portfolio based upon said market window;
wherein the step of presenting said local market position portfolio is further comprised of
presenting at least one of said market position summaries including said market interval within said market window.
141. The method of Claim 140,
wherein at least one of said market position summaries of said local market position portfolio is further comprised of an amount-held, a current bid summary, a current ask summary, a current market price and a current order
summary;
wherein the step of presenting said market position summary further comprising the steps of
presenting said included market interval;
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presenting said amount-held;
presenting said current bid summary;
presenting said current ask summary;
presenting said current market price; and
presenting said current order summary.
142. The method of Claim 141, further comprising the step of:
maintaining a market position database including the step of
maintaining at least one of said market positions containing at least one of said market intervals further including at least one member of the collection comprising the steps of
maintaining an amount-held associated with said market interval;
maintaining a current bid list associated with said market interval including at least one current bid;
maintaining a current ask list associated with said market, interval including at least one ask;
maintaining a current market price associated with said market interval; and

maintaining a current order list associated with said
market interval.
143. The method of Claim 142, further comprised of the step of:
establishing a client node belonging to said node collection of said AC
power network as said business location; and
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wherein the step maintaining said local market position portfolio is
further comprised of at least one member of a calculation collection
comprising the steps of:
calculating said current bid summary from said market position
database based upon said business location;
calculating said current ask summary from said market position
database based upon said business location; and
calculating said current market price from said market position
database based upon said business location.
144. The method of Claim 143,
wher ein at least one of said market intervals contains an AC **power**
transfer product type as said fungible, ephemeral commodity and
contains
said location as a first of said nodes directed to a second of said nodes
of said AC power network node collection.
145. The method of Claim 144, further comprised of the step of:
maintaining a flowgate collection containing at least two flowgate
entries;
wherein each of said flowgate entries contained in said flowgate
collection includes a factor, a from-node of said node collection and a
to-node
of said node collection;
wherein for each of said flowgate entries contained in said flowgate
collection, at least one of said market intervals contains said AC **power**

transfer product type as said fungible, ephemeral commodity and said
location
coinciding with said flowgate entry; and
172
wherein at least one member of said calculation collection is further
based upon said flowgate collection.
146. The method of Claim 145,
wherein said product type is further comprised of an AC **power** **transfer**

point-to-point product type as said fungible, ephemeral commodity.
147. The method of Claim 146,
wherein the step maintaining said current bid list is further comprised
of
io the steps of:
receiving a request for a point-to-point bid associated with said market
interval to create a received point-to-point bid request;
generating a point-to-point bid associated with said market interval
based upon said received bid request to create a new point-to-point bid
associated with said market interval further including the steps of:
generating a bid associated with said market interval containing said
AC **power** **transfer** product type and said location coinciding with
said flowgate entry, for at least one flowgate entry contained in said
flowgate collection; and
sending said new point-to-point bid associated with said market interval
2o based upon said received bid request as an order message.
148. The method of Claim 140,
wherein said market trade is associated with at least one of said
market intervals of said fungible, ephemeral commodity by said certified
client

with a member of the trade specification collection;
wherein said trade specification collection is comprised of
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a bid specification containing an amount, and a price;
an ask specification containing said amount, and said price; and
an order specification containing said amount and said price;
wherein the step managing said market trade collection is further comprised of the step of
presenting said market trade, for at least one of said market trades, further comprised of the steps of
presenting said market interval;
identifying said member of said trade specification collection;
presenting said amount; and
presenting said price.
149. The method of Claim 129,
wherein the step of managing said bilateral trading portfolio is further comprised of the steps of:
managing said bilateral trade, for each of said bilateral trades of said bilateral trading portfolio.
150. The method of Claim 129,
wherein the step of managing said bilateral trading portfolio is further comprised of the steps of:
receiving an authenticated bilateral trade notification message to create a received bilateral trade notification message;
updating said bilateral trading portfolio based upon said received bilateral trade notification message;
generating an initial bilateral trade;
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processing said initial bilateral trade to create an initial bilateral trade
message;
inserting said initial bilateral trade into said bilateral trading portfolio;
sending said initial bilateral trade message;
receiving a bilateral trade confirmation message to create a received bilateral trade confirmation request; and
inserting said received bilateral trade confirmation request into said bilateral trading portfolio.
lo 151. The method of Claim 150,
wherein the step of managing said bilateral trading portfolio is further comprised of the steps of:
responding to said received bilateral trade confirmation request to create a bilateral trade confirmation response;
inserting said bilateral trade confirmation response into said bilateral trading portfolio;
processing said bilateral trade confirmation response to create a bilateral trade confirmation response message; and
sending said bilateral trade confirmation response message.
152. The method of Claim 129,
wherein the step of managing said credit resource collection is comprised of the steps of:
managing said credit resource, for each of said credit resources of said credit resource collection.
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. The method of Claim 152,
wherein the step of managing said credit resource, for at least one of said credit resources of said credit resource collection, is further comprised of
the steps of:
receiving a credit resource message to create a received credit

resource message;
updating said credit resource based upon said received credit resource message;
presenting said credit resource;
preparing a credit resource request message; and
sending said credit resource request message to create a sent credit request.
154. The method of Claim 153,
wherein the step of receiving said credit resource message is further comprised of the step of:
receiving a credit request response message based upon said sent credit request to create a received credit request response.
155. The method of Claim 129,
wherein the step of managing said user resource, is further comprised of the steps of:
receiving a user resource schedule including a time interval to create a received schedule for said time interval;
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updating an operating schedule for said user resource based upon said received schedule for said time interval to create said operating schedule
containing an operating schedule entry for said time interval;
maintaining a real-time; and
controlling said user resource based upon said operating schedule for said user resource and based upon said real-time.
156. The method of Claim 155,
wherein said operating schedule entry for said time interval contained lo in said operating schedule for said user resource includes a capacity option
item; and
wherein the step of managing said user resource is further comprised of the steps of:
sending a capacity option exercise message for said time interval based said capacity option item to create a sent capacity option exercise; and
updating said operating schedule entry for said time interval based upon said sent capacity option exercise.
157. The method of Claim 156,
20' wherein the step of managing said user resource is further comprised of the steps of:
receiving a capacity exercise acknowledgment based upon said sent capacity option exercise to create a received capacity exercise acknowledgment; and
updating said operating schedule entry for said time interval based upon said received capacity exercise acknowledgment.
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. The method of Claim 157,
wherein said sent capacity option exercise includes an exercise amount;
wherein said received capacity exercise acknowledgment includes an acknowledgment amount;
wherein the step of managing said user resource is further comprised of the steps of:
determining if said exercise amount is greater than said lo acknowledgment amount; and
reporting a shortfall of said exercise amount minus said acknowledgment amount whenever said exercise amount is greater than said acknowledgment amount.
159. The method of Claim 129,
wherein said certified client acoustically communicates with said

transaction system to interactively use said transaction system

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160. The method of Claim 129,
wherein said transaction system is comprised of a client computer.. . . communicatively coupled to a server computer included in a server system;
wherein said certified client operates said client computer to interactively use said transaction system.
161. The method of Claim 160,
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wherein said server system provides a market engine supporting a virtual trading floor involving at least one of said fungible, ephemeral commodities.
162. The method of Claim 161,
wherein said server system further comprises an engine system supporting said virtual trading floor involving said fungible, ephemeral commodities.
lo 163. The method of Claim 160,
wherein said client computer is controlled by a program system containing program steps residing in a memory accessibly coupled to said client computer;
wherein said program system is comprised of at least two members each implementing a member of said basic usage collection. 164. A transaction system for supporting transactions involving at least one fu,ngible, ephemeral commodity, comprising:
a means for using said transaction system communicatively coupled to 2o a certified client further comprising:
a means for said certified client initiating at least one action in said transaction system; and further comprised of at least two members of the basic usage means collection comprising of:
a means for managing at least one user resource;
a means for managing a bilateral trading portfolio comprising at least one bilateral trade in at least one of said fungible, ephemeral commodities,
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a means for managing a market position portfolio comprising market positions of at least one of said fungible, ephemeral commodities;
a means for managing a market trading collection comprising at least one market trade in at least one of said fungible, ephemeral commodities;
a means for managing a credit resource collection comprising at least one credit resource; and
a means for managing compliance reporting based upon at least one member of the collection comprising said user resources, said market position portfolio, said bilateral trading portfolio and said market trading collection.
165. The system of Claim 164,
wherein said means for said certified client initiating said action in said
transaction system is further comprised of at least one member of the collection comprising:
a means for initiating a bid for a' market interval at a bid price and a bid
amount as a first validated order;
a means for initiating an ask for a market interval at a ask price and a ask amount as a second validated order;
a means for responding to a financial commitment presented by said transaction system to create a financial response to said financial commitment;
a means for reporting at least one of said bilateral trades to said transaction system; and

a means for confirming at least one of said bilateral trades to said transaction system;
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wherein said market interval includes a product type associated with at least one of said fungible, ephemeral commodities for at least one location for at least one time interval.
166. The system of Claim 165,
wherein said means for responding to said financial commitment presented by said transaction system is further comprised of at least one member of the collection comprising
a means for creating a financial payment of said financial commitment io in said transaction system; and
a means for creating a financial counter-response to said financial commitment in said transaction system.
167. The system of Claim 164,
wherein said means for managing said user resource further comprises at least one member of the collection comprising:
a means for managing a generator.of at least one of said fungible, ephemeral commodities;
a means for managing a load consuming at least one of said fungible, ephemeral commodities;
a means for managing a transmission facility for at least one of said fungible, ephemeral commodities;
a means for managing an import providing at least one of said fungible, ephemeral commodities; and
a means for managing an export consuming at least one of said fungible, ephemeral commodities.
181
. The system of Claim 167,
wherein said means for managing said user resource is further comprised of:
a means for creating a first knowledge interval of said ephemeral, fungible commodity at a first time interval containing a first cost in said
knowledge interval collection; and at least one member of the collection comprising:
a means for maintaining a bid interval collection of bid intervals of said lo ephemeral, fungible commodit , each comprised of a bid price, a bid amount,
and a bid time interval; and
a means for maintaining an ask interval collection of ask intervals of said ephemeral, fungible commodity, each comprised of a ask price, a ask amount, and a ask time interval;
wherein said means for creating said first knowledge interval is comprised of:
a means for receiving a knowledge interval creation message to create a received knowledge interval creation message; and
a means for creating said first knowledge interval of said ephemeral, fungible commodity at said first time interval containing said first cost in said knowledge interval collection based upon said received knowledge interval creation message.
169. The system of Claim 168,
wherein said means for managing said user resource is further comprised of:
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a means for determining said ephemeral, fungible commodity needs over a planning time interval; and
a means for determining an equipment usage plan based upon said knowledge interval collection containing an equipment usage item of said user resource comprised of an activation time and an action belonging to

an action collection comprising start-action, stop-action and throttle-action to create a
resource operating schedule; and
a means for operating said equipment usage item of said user resource based upon said device operating schedule.
170. The system of Claim of 169,
wherein said means for managing said user resource is further comprised of:
a means for examining an equipment usage collection comprised of equipment usage entries each containing a delivery time and a need schedule for said ephemeral, fungible commodity to create said ephemeral, fungible commodity needs over said planning time interval comprises an amount.
171. The system of Claim of 170,
wherein said ephemeral, fungible commodity needs over said planning time interval further comprises a cost limit; and
wherein said means for said certified client initiating said bid is further
comprised of:
a means for making said bid of a first bid amount at a first bid price within said cost limit for said first time interval of said ephemeral, fungible commodity.
183
. The system of Claim 169,
wherein said means for operating said equipment usage item based upon said device operating schedule is further comprised of at least one member of the collection comprising
a means for starting said equipment usage item of said user resource;
a means for stopping said equipment usage item of said user resource; and
a means for throttling said equipment usage item of said user resource.
173. The system of Claim 164,
wherein said means for managing said market position portfolio is comprised of:
a means for maintaining a market window;
a means for maintaining a local market position portfolio comprised of at least one market position summary, each of said market position summaries including a market interval of said fungible, ephemeral commodity
within said market window;
a means for presenting said local market position portfolio based upon said market window;
wherein said means for presenting said local market position portfolio is further comprised of:
a means for presenting at least one of said market position summaries including said market interval within said market window.
174. The system of Claim 173,
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wherein at least one of said market position summaries of said local market position portfolio is further comprised of an amount-held, a current bid summary, a current ask summary, a current market price and a current order
summary;
wherein said means for presenting said market position summary further comprising:
a means for presenting said included market interval;
a means for presenting said amount-held;
a means for presenting said current bid summary;
a means for presenting said current ask summary;
a means for presenting said current market price; and

a means for presenting said current order summary.
175. The system of Claim 174, further comprising:
a means for maintaining a market position database including:
a means for maintaining at least one of said market positions containing at least one of said market intervals further including at least
one member of the collection comprising:
a means for maintaining an amount-held associated with
said market interval;
a means for maintaining a current bid list associated with
said market interval including at least one current bid;
a means for maintaining a current ask list associated with
said market interval including at least one ask;
a means for maintaining a current market price
associated with said market interval; and
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a means for maintaining a current order list associated
with said market interval.
176. The system of Claim 175, further comprising:
a means for establishing a client node belonging to said node collection of said AC power network as said business location; and
wherein said means for maintaining said local market position portfolio is further comprised of at least one member of a calculation collection comprising:
a means for calculating said current bid summary from said market position database based upon said business location;
a means for calculating said current ask summary from said market position database based upon said business location; and
a means for calculating said current market price from said market position database based upon said business location.
177. The system of Claim 176,
wherein at least one of said market intervals contains an AC pow er transfer product type as said fungible, ephemeral commodity and contains said location as a first of said nodes directed to a second of said nodes of said AC power network node collection.
178. The system of Claim 177, further comprising:
a means for maintaining a flowgate collection containing at least two flowgate entries;
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wherein each of said flowgate entries contained in said flowgate collection includes a factor, a from-node of said node collection and a to-node
of said node collection;
wherein for each of said flowgate entries contained in said flowgate collection, at least one of said market intervals contains said AC **power**

transfer product type as said fungible, ephemeral commodity and said location
coinciding with said flowgate entry; and
wherein at least one member of said calculation collection is further based upon said flowgate collection.
179. The system of Claim 178,
wherein said product type is further comprised of an AC **power transfer**

point-to-point product type as said fungible, ephemeral commodity.
180. The system of Claim 179,
wherein said means for maintaining said current bid list is further comprised of:
a means for receiving a request for a point-to-point bid associated with said market interval to create a received point-to-point bid request;

a means for generating a point-to- point bid associated with said market interval based upon said received bid request to create a new point-to-point
bid associated with said market interval further including:
a means for generating a bid associated with said market interval containing said AC **power transfer** product type and said location coinciding with said flowgate entry, for at least one flowgate entry contained in said
flowgate collection; and
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a means for sending said new point-to-point bid associated with said market interval based upon said received bid request as an order message.
181. The system of Claim 173,
wherein said market trade is associated with at least one of said market intervals of said fungible, ephemeral commodity by said certified client
with a member of the trade specification collection;
wherein said trade specification collection is comprised of
a bid specification containing an amount, and a price;
an ask specification containing said amount, and said price; and
an order specification containing said amount and said price;
wherein said means for managing said market trade collection is further comprised of
a means for presenting said market trade, for at least one of said' market trades, further comprised of
a means for presenting said market interval;
a means for identifying said member of said trade specification collection;
a means for presenting said amount; and
a means for presenting said price.
182. The system of Claim 164,
wherein said means for managing said bilateral trading portfolio is further comprising:
a means for managing said bilateral trade, for at least one flowgate entry contained in said flowgate collection.
188
. The system of Claim 164,
wherein said means for managing said bilateral trading portfolio is further comprised of:
a means for receiving an authenticated bilateral trade notification message to create a received bilateral trade notification message; and
a means for updating said bilateral trading portfolio based upon said received bilateral trade notification message;
a means for generating an initial bilateral trade-,
a means for processing said initial bilateral trade to create an initial bilateral trade message;
a means for inserting said initial bilateral trade into said bilateral trading
portfolio; and
a means for sending said initial bilateral trade message;
a means for receiving a bilateral trade confirmation message to create a received bilateral trade confirmation request; and
a means for inserting said received bilateral trade confirmation request into said bilateral trading portfolio.
184. The system of Claim 183,
wherein said means for managing said bilateral trading portfolio is further comprised of:
a means for responding to said received bilateral trade confirmation request to create a bilateral trade confirmation response;
a means for inserting said bilateral trade confirmation response into

said bilateral trading portfolio;
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a means for processing said bilateral trade confirmation response to create a bilateral trade confirmation response message; and
a means for sending said bilateral trade confirmation response message.
185. The system of Claim 164,
wherein said means for managing said credit resource collection is comprised of:
a means for managing said credit resource, for each of said credit io resources of said credit resource collection.
186. The system of Claim 185,
wherein said means for managing said credit resource, for at least one of said credit resources of said credit resource collection, is further comprised
Of:
a means for receiving a credit resource message from said transaction system to create a received credit resource message;
a means for updating said credit resource based upon said received credit resource message;
a means for pre senting said credit resource;
a means for preparing a credit resource request message; and
a means for sending said credit resource request message to create a sent credit request.
187. The system of Claim 186,
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wherein said means for receiving said credit resource message is further comprised of:
a means for receiving a credit request response message from said transaction system based upon said sent credit request to create a received credit request response.
188. The system of Claim 164,
wherein said means for managing said user resource, is further comprised of:
a means for receiving a user resource schedule including a time interval from said transaction system to create a received schedule for said
time interval;
a means for updating an operating schedule for said user resource based upon said received schedule for said time interval to create said operating schedule containing an operating schedule entry for said time interval;
a means for maintaining a real-time; and
a means for controlling said user resource based upon said operating schedule for said user resource and based upon said real-time.
189. The system of Claim 188,
wherein said operating schedule entry for said time interval contained in said operating schedule for said user resource includes a capacity option
item; and
wherein said means for managing said user resource is further comprised of:
191
a means for sending a capacity option exercise message for said time interval based said capacity option item to create a sent capacity option exercise; and
a means for updating said operating schedule entry for said time interval based upon said sent capacity option exercise.
190. The system of Claim 189,
wherein said means for managing said user resource is further

comprised of:
a means for receiving a capacity exercise acknowledgment based upon said sent capacity option exercise to create a received capacity exercise
acknowledgment; and
a means for updating said operating schedule entry for said time interval based upon said received capacity exercise acknowledgment.
191. The system of Claim 190,
wherein said sent capacity option exercise includes an exercise amount;
wherein said received capacity exercise acknowledgment includes an acknowledgment amount;
wherein said means for managing said user resource is further comprised of:
a means for determining if said exercise amount is greater than said acknowledgment amount; and
192
a means for reporting a shortfall of said exercise amount minus said acknowledgment amount whenever said exercise amount is greater than said acknowledgment amount.
192. The sys tem of Claim 164,
wherein said means for using said transaction system supports at least one member of the collection comprising:
said certified client acoustically communicating with said transaction system to interactively use said transaction system;
said certified client communicating in a tactile fashion with said transaction system to interactively use said transaction system;
said certified client communicating in a wireless fashion with said transaction system to interactively use said transaction system; and
said certified client communicating in a wireline fashion with said transaction system to interactively use said transaction system.
193. The system of Claim 164,
wherein said transaction system is further comprised of at least one computer operated by said certified client and controlled by a program system comprised of program steps residing in a memory accessibly coupled to said computer.
194. The system of Claim 193,
wherein said means for using said transaction system is implemented as at least one of said program steps in said program system.
193
. The system of Claim 193,
wherein at least one member of said basic usage means collection is implemented as at least one of said program steps in said program system.
196. The system of Claim 193,
wherein said means for said certified client initiating said action is implemented as at least one of said program steps in said,program system.
197. The system of Claim 164,
wherein said transaction system is further comprised of a client computer communicatively coupled to a server computer included in a server
system;
wherein said certified client operates said client computer to interactively use said transaction system.
198. The system of Claim 197,
wherein said server system provides a market engine supporting a virtual trading floor involving said fungible, ephemeral commodities.
199. The system of Claim 198,
wherein said server system further comprises an engine system supporting said virtual trading floor involving said fungible, ephemeral commodities.

T S9/9/2

9/9/2 (Item 1 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB

13201562 SUPPLIER NUMBER: 70695352 (THIS IS THE FULL TEXT)
RTOs in depth: size, scope, and operation.(regional transmission organizations; GridFlorida, GridSouth, SE Trans and RTO West.)
Radford, Bruce W.
Public Utilities Fortnightly (1994), 139, 2, 14
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TEXT:

Electric industry views on GridFlorida, GridSouth, SE Trans, and RTO West.

AS LAST YEAR DREW TO A CLOSE, MORE than a half-dozen plans emerged to form new regional transmission organizations (RTOs), but if the hue and cry that followed offers any indication, then the applicants certainly have a long way to go before winning certification from the Federal Energy Regulatory Commission, according to the rules set for RTOs set by FERC under Order 2000, issued in 1999.

What's at stake is the complete restructuring of the transmission sector of the privately owned segment of the U.S. electric utility industry. But even as the RTOs rolled out their separate visions of the future, uncertainty reigned in California and in the Midwest, where the FERC already had certified two independent system operators (ISOs), now seen as precursors of RTOs.

In California, some 28,000 megawatts of utility-owned generation was returned to state control by the FERC in a decision issued on Dec. 15. The FERC urged more bilateral trading, to reduce the influence of markets run by the state's power exchange and ISO.

And in the nation's midsection, Dynegy (parent company of Illinois Power) threw a curve at the Midwest ISO by stating that it would exercise its " **contractual** right" to withdraw from the group and instead cast its lot with the Alliance RTO, not yet formulated.

Dynegy said it was too early for the FERC to rule on the scope and configuration of Alliance vis-a-vis MISO, but Robert Tongren, the Ohio Consumers' Counsel, fired back: "In fact, the commission cannot rule on Dynegy's request (to withdraw) without effectively ruling on the scope and configuration of the MISO" Many urged that only one RTO should form in the Midwest.

Here we offer an in-depth look at four major new RTO proposals: SE Trans (Southern Companies), GridFlorida, GridSouth, and RTO West.

Of the four, the plan by the Southern Companies is seen as the "worst practice" with RTO West touted as "best"--at least by attorney Sara Schotland, representing the views of ELCON, the Electric Consumers Resource Council. By contrast, Schotland sees the "binary" RTO partnership between Entergy and the Southwest Power Pool as "quite odd" (That RTO is not covered here, but turn to page 33, for more on that plan, and PJM and DesertSTAR, in the commentary by Lynne Church, of the Electric Power Supply Association.)

Otherwise, note that none of the group has yet proposed to form its own power exchange. What does that say about power markets?

SE Trans Grid: A Big Enough Footprint?

With little input from others, the Southern Companies promote their for-profit gridco, assailed by critics as a one-company system.

The Southern Companies say that when they began to (think about

forming or joining an RTO in early 1999, they imagined they would simply sell their transmission network to a third party. But when no buyer came forward, the utility system turned to plan B--a spin-off. If either of these efforts had proven successful, the utility explains, then many of the complaints and criticisms raised about Southern's potential control and dominance over its proposed RTO would have faded away. But neither spin-off nor sale was in the cards.

"Unfortunately" says Southern, "the investment community made dear late in the summer of 2000 that they believed a spin-off was not a realistic option. Their concern was that the stock of such a spin-off company would trade at a discount to the vertically integrated utility and thereby devalue the shareholders' assets"

In short, says Southern, the investment community was "troubled" by the "lack of a track record" in the United States for a stand-alone transmission company. Analysts also questioned whether federal regulators would allow a high-enough return on investment to float such an enterprise, it adds.

So, while Southern insists that as late as December 2000 it was still continuing "to explore" divestiture options, the lack of a deal last summer left the utility with little time to switch strategies and still comply with deadlines imposed by the FERC in Order 2000. The utility quickly held two meetings in September in Atlanta and Birmingham, Ala. At those meetings it presented a few details of its nascent plan--and even took a little input from the public--but decided eventually to abandon any attempt to develop an RTO plan through open collaboration.

"Under these circumstances," said Southern, "a public stakeholder negotiation process could interfere." And perhaps that is why many in the region have decried the Southern proposal as not so much an RTO as an internal corporate business plan.

"Essentially," say the Williams Companies, "the Southern gridco model is a single utility system cloaked and slightly reconfigured to appear as an RTO."

"There has been little give-and-take in the development of Southern's RTO proposal," adds MEAG, the Municipal Electric Authority of Georgia, which owns transmission assets that form part of the Georgia Integrated Transmission System (ITS). "Southern's RTO-related meetings have been primarily informational in nature and Southern has made clear that these meetings were not negotiations.... The various phases of that proposal have been developed internally among only the Southern Operating Companies"

The steelmaker Birmingham Southeast puts it all in simpler terms: "The philosophy of the Southern Companies in planning this RTO can be described as a complete unwillingness to give up control"

Issues and Attributes

Southern insists that the "footprint of the gridco is likely to expand over time." Yet some question where such expansion will come from.

Peter Fox-Penner, a transmission expert at The Brattle Group testified on behalf of Morgan Stanley Capital Group that Southern "does not appear' to have won the support of the other neighboring transmission owners and utilities that Southern lists as likely candidates to join the RTO, such as MEAG, the Georgia Transmission Corp. (GTC), Alabama Electric Co-op, and South Mississippi Electric Power Association (SMEPA).

As planned, the Southern RTO would cover 122,000 square miles, larger than ISO New England, more than double the size of the PJM or New York ISOs, but some 20 percent smaller than the California ISO. Yet the Southern RTO system would only cover the southern subregion of the Southeastern Electric Reliability Council (SERC). Within that small proposed RTO area, says GTC, the Southern Companies own 75 percent of the total transmission miles and 70 percent of the generating capacity, thus ensuring what GTC calls "Southern's overwhelming dominance"

Enron sees "no operational or market-based reason" why Southern's RTO should not combine with GridSouth in the Carolinas. "By balkanizing the region along state boundaries" says Enron,"these two proposals divide recognized trading patterns. GTC maintains that the optimal geographic scope of a Southeast RTO would extend all the way from Entergy's system to the Southwest, and through the Southern system and GridSouth, as well as include GridFlorida and Tennessee Valley Authority.

Other regional players have raised dozens of other issues and allegations, running the gamut from governance and management to markets and congestion management:

* GOVERNANCE. Southern will exert undue influence as a passive owner over initial selection of a search committee for choosing directors or an interim CEO.

* VETO POWER. Unfair to give each participating TO the right to "strike" one candidate for board membership without cause.

* GRID UPGRADES, Confusion persists about who--the RTO or the TOs?--has authority over system planning and expansion.

* NATIVE LOAD. The gridco tariff discriminates because it does not cover transactions where distribution utilities purchase transmission service to serve bundled retail load.

* RETURN ON EQUITY. Southern's ROE would be too high, since the rate plan would adopt ROE levels OK'd by state regulators in setting rates for traditional bundled retail service.

* REGIONAL SEAMS. Such a small RTO would create too many problems with parallel paths and loop flows, and would fail to internalize key constrained interfaces or coordinate seams between regions, and between the other RTOs proposed for the Southeast: GridFlorida and GridSouth.

* GENERATION. Lack of RTO standards for generation interconnection discourages merchant generation.

* FTRs. Allocation of firm transmission rights (physical rights keyed to flowgates) will perpetuate current inefficiencies and favor native load.

* FLOWGATE RIGHTS. A system of physical transmission rights based on flowgates is untried, and less efficient and reliable than financial rights.

* NODAL PRICING. The gridco's method for using nodal-based locational marginal pricing (instead of zonal) to govern bid-based markets for ancillary services and generation redispatch (for congestion relief) doesn't allocate costs properly and is not workable, given the tariff exemption for native load.

* LOAD BALANCING. Why not systemwide balancing instead of forcing individual market participants to balance heir particular transactions?

* GRIDCO COSTS. Rate recovery of gridco administrative costs creates double recovery, as state PUCs already include such costs in bundled retail rates of transmission-owning utilities.

* DIVERSIFICATION, Allowing the RTO to diversify and offer unrelated services, such as consulting, creates conflicts of interest.

The Southern Companies do not take all these criticisms lying down, however. Consider the right of passive (non-voting) transmission owners to exercise a single peremptory strike against a candidate for the board, which drew protests.

"This criticism is unwarranted," replied Southern in its answer filed in December. "A right to veto one of the initial candidates cannot seriously be considered to have sinister ramifications."

Contracts at Risk

Several of the municipal transmission-owning utilities identified by Southern as likely candidates to join the RTO already enjoy many RTO-like rights, courtesy of the Georgia Integrated Transmission System. In fact, the municipal systems want to know what would happen to their existing **contract** rights.

The GTS consists of approximately 16,000 miles of transmission lines owned either by MEAG, GTC, the city of Dalton municipal utility, or Georgia Power, a Southern subsidiary. By a series of bilateral **contracts** between the ITS owners, the ITS grants firm transmission rights similar to network service to ITS participants and assigns each co-owner the right to exclusive use of a load-ratio share of all interfaces adjoining the ITS. In one sense, the Georgia ITS already operates as a sort of de facto RTO. Listen to the Georgia Public Service Commission:

"Southern Companies have a unique relationship with some of the other nonjurisdictional transmission owners.... Under these agreements, the participating utilities have provided transmission service across the entire State of Georgia using each other's facilities--much like an RTO--for over 25 years"

In short, the municipal utilities in Georgia want to know how the RTO would reconcile existing transmission rights under ITS agreements before the munis commit themselves as participants, or even before the FERC approves the RTO. And the Georgia PSC believes that the FERC should accept the RTO plan only on condition that all three proposed RTOs in the Southeast would merge within three to five years.

In a similar vein, Duke Energy objects that Southern's RTO would give a right of first refusal to TOs for building transmission upgrades. "This ceding of control" says Duke, "should be eliminated from the proposal."

Yet Southern offers a plausible reason: "This proposal (a right of first refusal) recognizes that the new construction would be interconnected with existing facilities and that such work would likely be performed more expeditiously if it is done by the existing transmission owner who presumably has the right of eminent domain and the requisite technical qualifications."

To encourage wider participation by municipal utilities afraid of losing tax-exempt status if assets are devoted to a private use, AMEA and the American Public Power Association offer an ingenious solution: hard cash.

"The gridco should have at least the authority to purchase transmission assets offered for cash at prices up to net book value.... An option to sell for cash is needed to encourage the broadest possible RTO participation."

Meanwhile, the Southern RTO would demand its own set of cash incentives. The plan asks for a premium added to rate of return for investments that increase interregional transmission capacity, improve performance of wholesale markets, or that carry unusual risk because of a threat of transmission bypass. That notion raised hackles at the Alabama Electric Co-op.

"Southern claims that its for-profit gridco would find it difficult to raise investment capital without a broad array of incentives. Yet the Southwest Power Pool ... has a $2 million line of credit and is in the process of securing nearly $20 million in financing as a result of its RTO role. SPP expects at least an `A' rating from Moody's and a `BBB-' rating from Standard & Poor's, the same ratings given to the Midwest ISO earlier this year"

Flowgates and koopflows

Morgan Stanley Capital Group argues that the "high volume" of Southern's internal **power transfers** will impose "substantial loop flow effects" on neighboring transmission systems. Testifying for Morgan Stanley, Peter Fox-Penner relied on the **Power Transfer** Distribution Factors (TDF) Viewer developed by the North American Electric Reliability Council to analyze the magnitude of parallel path flows that control-area-to-control-area transactions within the Southern Subregion would impose on the Entergy and TVA systems.

According to Fox-Penner, a 100-megawatt transaction from the

Southern system to SEPAL would cause a parallel path flow of 32.5 MW on the Southern-TVA interface, a 33.6-MW flow on the TVA-Entergy interface, and between 5 MW and 18 MW on eight other TVA and Entergy flowgates--including 15.3 MW on the Brown-Sequoyah 500 flowgate (jointly owned by Southern and TVA) on which transmission loading relief (TLR) events of Level 3 and above were called 11 times this past summer.

Such testimony draws attention to the fact that the Southern gridco would rely on physical firm transmission rights (FTRs) tied to "flowgates" defined as transmission facilities or interfaces reasonably expected to experience congestion during certain periods. Southern says its RTO would begin operation with approximately 40 flowgates controlled by the gri&o. This idea--to use physical rather than financial rights to hedge against congestion--has evoked concern.

"A major problem," argues SMEPA, "is that the granting of a firm reservation will be limited to the available capacity on the most constrained flowgate.

"For example, suppose there is a 100-MW firm transmission request from Area A to Area B (that) will affect **flow - gates** 1, 2, 3, and 4 equally. There are 25 MW of available transmission capacity on three of the fiowgates. However, because the fourth flowgate can accommodate only 20 MW, the request will be denied. Even worse, because of the PDFs (TDFs in Fox-Penner's lexicon), the maximum reservation that could be made is 80 MW (20 + 20 + 20 + 20), not 95 MW (25 + 25 + 25 + 20). The firm customers should be offered the FTRs individually, not as a bouquet (so) the secondary market will have more depth and usefulness"

SMEPA also adds a plug for financial FTRs, which it believes will work better than physical rights in adapting to changing market conditions:

"Transmission lines are removed from service, forced outages occur, and transformer taps change. The transmission system is dynamic, PDFs will change, and flows caused by particular transactions will change. The transmission customer who thought it was protected by its FTRs may not be"

Taking the complexity one step further, Georgia Transmission Corp. questions Southern's plan to conduct its bid-based markets for ancillary services and redispatch according to nodal-based, locational marginal pricing (LMP).

"LMP calculated on a nodal basis represents a dramatic change ... a zonal-based LMP system would help all gridco customers to gradually transition into the new RTO world.

"Unlike the Mid-Atlantic region (i.e., PJM), the transmission and generation assets in the Southern subregion are highly interrelated. ... (T)ransmission maintenance neglected by one participant could result in redispatch costs for another partidpant. ... Zonal LMPs would tend to pool the exposure of RTO participants, so that such costs would fall at least in part on the responsible party.

"Bidding markets within zones to supply ancillary services would undoubtedly be more robust than on a nodal basis, where individual entities are likely to have much greater market power and may even monopolize a particular flowgate"

Political Reality

Overall, the Southern Companies face unique problems owing to the fact that the state of Georgia has not yet adopted a plan to introduce unbundling and retail competition.

In fact, the Georgia Public Service Commission made a point of reminding the FERC that the PSC still "has the authority to set bundled retail transmission rates." Contrary to the run of comments, the PSC still believes that it is perfectly "appropriate" for the gridco to place native load outside the scope of its tariff.

The Southern Companies allude to the political quandary in explaining why they chose to give special status to native load under the gridco tariff.'

"(We) have attempted to minimize the impacts of RTO formation on retail customers by proposing to not unbundle retail transmission. ... By doing so, (we) hope to move forward ... without becoming embroiled in a jurisdictional conflict. ... Critics of this approach have failed to suggest any other way to resolve the concerns of the Public Service Commission."

Alabama vs. Georgia?

How a native load exemption might shift costs from one state to another.

The Southern Companies propose that electric distribution utilities would not be required to purchase transmission service under the RTO tariff to serve their bundled retail service, or so-called "native load." Here, the Alabama Municipal Electric Authority (AMEA) and the American Public Power Association explain how that native load exclusion might force many Alabama consumers (those served by transmission-dependent utilities) to pay higher rates than their counterparts in Georgia:

"ON A PER-KILOWATT BASIS, the cost of Georgia Power's transmission system has long been higher than the costs of the other Southern Companies, and it will no doubt continue to be so for several years. The cost of Alabama Power's system, by contrast, is lower than the average for all Southern Companies.

"UNDER SOUTHERN'S PROPOSAL, the retail loads of Alabama Power would continue to enjoy their lower average cost, but wholesale customers and transmission-dependent utilities in Alabama (including AMEA) would pay the higher Southern-wide average rate, denying them comparability with Alabama Power's retail service, with which they directly compete.

"SOUTHERN'S COMPETITIVE ADVANTAGE in Alabama, however, is not offset by a competitive disadvantage in Georgia. Under Georgia's Integrated Transmission System Arrangement, the vast majority of wholesale loads remain in load-ratio parity with Georgia Power (not the entire Southern Company). In other words, where Southern has higher than average transmission costs (in Georgia), most wholesale loads have been locked into the same high cost. And where Southern has lower than average costs (in Alabama), Southern seeks to retain those lower costs for itself, while forcing adjacent competitors (including AMEA) to the higher Southern-wide average.

"ONE MIGHT SUPPOSE THAT planned or projected transmission additions or expansions in the various operating company areas will reduce or eliminate the existing cost disparities. However, this is far from certain.... This is because Southern proposes that its subsidiaries (as the incumbent transmission owners) have the right of first refusal in constructing and owning new transmission facilities.

"GRIDCO SHOULD BE REQUIRED to offer zonal, license-plate rates within the regions of each of the Southern operating companies such that wholesale transmission customers and transmission-dependent utilities are subject to the same average costs as the respective Southern Company affiliates."

Source: Protest of AMEA and APPA, pp, 25-26, FERC Docket No. RTO1-77, filed Nov. 20, 2000.

Data Box--SE Trans

NAME: SeTrans Grid Company, LLC.

SPONSORS: Southern Company Services, Inc. (agent for Alabama Power Co., Georgia Power Co., Mississippi Power Co., and Savannah Elec.& Power Co.)

POSSIBLE PLAYERS: Georgia Transmission Corp. (GTC), the Municipal Electric Authority of Georgia (MEAG), Alabama Electric Co-op. Inc., South Mississippi Elec. Power Asso. (SMEPA).

SIZE: 25,000 miles of transmission network (voltages at or above 40 kV) covering 122,000 square miles across a four-state area (parts of Georgia, Alabama, Mississippi and Florida), valued at $2 billion.

STRUCTURE: For-profit limited liability company (gridco). Operates grid facilities of transmission owners. TOs participating as RTO members hold passive (non-voting) equity interests. Gridco could operate facilities of non-participating TOs.

GOVERNANCE: To be determined, from three alternatives: (A) Board of Directors (7 seats), (B) a managing partner (with TO participants as passive, non-voting partners), or (C) a separate management company ("Newco") that functions essentially as a for-profit ISO and signs operating agreements with transmission owners, none of whom retain an equity interest in the RTO.

MARKETS: Bilateral trading for commodity energy. No power exchange or similar central auction. But a central bid-based market for ancillary services, and for redispatch to manage congestion, using nodal-based locational marginal pricing (LMP).

CONGESTION RIGHTS: RTO allocates physical firm transmission rights (FTRs), representing options to use certain constrained "flowgates" to complete a **contract** path reservation. Those not holding FTRs bid for redispatch (nodal LMP market, see above), or accept curtailment.

RATES AND TARIFFS: Preserves traditional status of native load (gridco tariff does not cover transmission service purchased to serve bundled retail load. TOs set revenue requirement per their own five-year plans for system expansion. Return on equity set not by FERC, but according to ROEs for bundled retail services, as set by state PUCs. Rates include PBR incentives (performance-based ratemaking).

KEY ISSUES: Criticized as too small to serve as an RTO--not internalizing loop flows or key interfaces in SE region. Said to preserve status quo by perpetuating load patterns, especially through FTR allocations and native load exemption, thus ensuring alleged dominance of Southern Companies in transmission and generation. Must reconcile RTO proposal with existing **contracts** that set up an integrated transmission system in Georgia and that allow all ITS participants to use grid facilities owned by other ITS members on a reciprocal basis.

Source: FERC Docket No. RT01-77, as updated through answer filed Dec. 4, 2000.

GridFlorida: The "Island" Transco

The state commission loves it--but why an RTO that serves only local interests?

Like the much-maligned California ISO on the opposite coast, GridFlorida, the for-profit transco sponsored by Florida Power & Light, Florida Power Corp., and Tampa Electric, would operate entirely within a single state. That spells trouble in the minds of many.

And so the Florida Public Service Commission, which sees a single-state RTO as enhancing its own authority, has come out in favor of GridFlorida, letting everyone know that the Florida RTO will not become "another California"

"We understand" says the PSC, "that some members of the FERC are of the impression that the problems in California's electricity market are due to a single-state ISO. ... (But) Florida differs from California's system."

As the RTO sponsors say in their application, "Florida is essentially an electrical island"

Echoing that claim, the Florida PSC takes the distinctly minority view that the correct geographic scope for any RTc operating in Florida is "peninsular Florida"--that part of the state east and south of the Appalachicola River, which coincides neatly with the existing boundaries of the Florida Reliability Coordinating Council (FRCC). The PSC argues that states need to "play an active role" in RTO affairs--especially Florida, where the state's "Grid Bill" vests the PSC with jurisdiction over planning, development, and maintenance of electric transmission facilities.

"Florida must continue to exercise authority over reliability," adds the PSC. "Ceding authority to FERC--without a sufficient and clear state

role--could create unintended consequences."

The PSC acknowledges that utilities within peninsular Florida are highly interconnected, but that the area has little import and export capability with the Southern Companies to the North (the only interconnection). Thus, it insists that Florida "is not dependent on out-of-state energy in the way California is,' and offers this comparison:

California vs. Florida
Reliance on Power Imports

System Attributes	California	Florida
Peak Demand	53,097	40,178(*)
(MW, 1999)	17,926	3,600
Max. Import Capacity (MW, 1999)		
Share of Peak Demand	33.76%	8.96%

(*) Winter, 1999/2000.

Source: Western Systems Coordinating Council, June 2000; Florida Reliability Coordinating Council, July 2000, as compiled by Fla. P.S.C.

Nevertheless, not everyone agrees with this view, especially JEA, formerly known as the Jacksonville Electric Authority.

"Florida is not an island" says JEA. "It is a peninsula that imports a significant amount of power over the Southern/Florida interface. Any properly configured RTO would encompass the entire FRCC reliability region and account for all of the facilities at the Southern/Florida interface. As a result, Florida border utilities cannot justify participating in the RTO."

Moreover, the PSC admits that because of its "island" nature, the RTO will likely benefit Floridians only if it furthers the construction of additional generation within the state. And that is where the PSC admits to problems. The PSC cites the recent ruling of the state Supreme Court in the Smyrna Beach case, that turned down a construction permit for new merchant generation. "The status of state law is undear," says the PSC.

Indeed, others put it more bluntly.

According to Dynegy, the environment in Florida for merchant generation "can fairly be characterized as 'hostile' due to the active opposition.., by the incumbent integrated utilities. These same utilities also happen to be the primary sponsors and architects of GridFlorida."

As of mid-December, GridFlorida had promised but had not yet filed a supplemental application that was to contain full details about the transco's proposed market structure, including governance, pricing, market structure for ancillary services and congestion, interregional coordination, market monitoring, and other functions and attributes of RTOs as required under FERC Order 2000.

However, the sponsors had offered considerable detail about their proposal to recover embedded costs for the transmission network through a zonal, license-plate charge, based on costs within the zone in which the load is located.

That proposal had evoked opposition from JEA, which argued that license plate pricing would be ill-suited to the Jacksonville area, where power flows would occur primarily in only one direction. (See Sidebar, "Unbalanced Zones?")

Unbalanced Zones?

Why Jacksonville sees a problem with license-plate pricing.

JEA, formerly known as the Jacksonville Electric Authority, says it has invested heavily in firming up upstate interfaces with the Southern Companies, and believes that such costs will be left unrecovered under zonal license-plate pricing, which will favor costs incurred downstate, where the load is.

"A REGIONAL LICENSE PLATE PRICING MECHANISM, in which transmission rates are based on the location of load (i.e., the sink), is equitable only

in circumstances where there is a relative balance between flows into and out of each license plate zone. If power typically flows in only one direction, then load-based license plate rates simply benefit those utilities that have significant amounts of power flowing into their zones. More problematic ... there is simply no incentive to develop generation facilities close to load.

"GRIDFLORIDA'S ... MECHANISM ... INEQUITABLE to JEA, a utility with significant investments in the Florida-Georgia interface. While JEA typically transmits power to serve load in the South, the transmission facilities of southern utilities generally are not utilized to deliver power to load served by JEA. ... (However), Florida is generation-deficient, making the Florida-Georgia interface a critical facility in meeting load demands in the State..

"OTHER OPTIONS SHOULD BE CONSIDERED. For example, transmission charges for an RTO operating in Florida could consist of a single licenseplate access fee based on the zone importing or hosting generation, not the zone hosting load."

Source: Motion of JEA to Intervene and Protest, pp. 12-13, FERC Docket No. RT01-67, filed Nov. 20, 2000.

Data Box--GridFlorida

(Note: Though GridFIorida filed an RTO application on Oct. 16, 2000, complete with proposals on rates, market structure, and congestion management, it asked FERC only to OK certain proposals regarding (1) selection of board members and a CEO, (2) criteria for qualification of directors and officers, and (3) restrictions on financial holdings of directors, employees, and their relatives.

It said that all other details were subject to change. GridFIorida filed its followup proposal on Dec. 15--too late to be analyzed here. Thus, only a bare outline of the RTO is presented.)

NAME: GridFIorida, LLC (owned by GF Inc., a separate company.)

SPONSORS: Florida Power & Light Co., Florida Power Corp., Tampa Electric Co. (FP&L would divest its grid assets. FPC would retain ownership. Tampa was still pondering its options as of mid-December.)

STRUCTURE: For-profit transco. Would own grid assets acquired from FP&L, and operate grid facilities retained by other participating TOs not divesting such assets.

MARKETS: Bilateral trading for commodity energy. No power exchange or similar central auction. Bid-based markets for ancillary services and congestion.

CONGESTION RIGHTS: RTO allocates physical transmission rights (FTRs), keyed to flowgates. No financial rights implied by FTRs. Zonal prices for congestion. Costs of intrazonal congestion are recovered within the zone (i.e., not "socialized").

RATES AND TARIFFS: Zonal license-plate access charge to recover embedded costs of transmission system (retained for five years), with systemwide postage-stamp charge to recover incremental costs for investment added after RTC) formation. Zonal license-late charge is phased-out over years six-10, in transition to single, systemwide postage-stamp rate after 10 years.

KEY ISSUES: Criticized as too small to serve as an RTO--but no allegations of external loop flows. Questions about relying on physical congestion rights based on flowgates, plus alleged dominance by FP&L, apparently the only utility planning to divest its transmission to the transco.

Source: FERC Docket No. RT01-67, as updated through answer filed Dec. 5, 2000.

GridSouth: Business First, Markets Later

RTO will wait before launching any plan for real-time pricing.

To the Carolina Utility Customers Association, it is a mere "bureaucratic overlay" --layered on top of three unchanged utility systems.

South Carolina's Consumer Advocate calls it a "paper tiger"--with the real authority resting in the hands of utility transmission owners. And the South Carolina Public Service Authority (more widely known as "Santee/Cooper") feels left out in the cold. It complains that the collaborative process leading up to the proposal was, "to be charitable, sub-par"

Yet, to its three ground-floor sponsors, Carolina Power & Light, Duke Energy, and South Carolina Electric & Gas, the proposed GridSouth RTO is nothing but a cold, hard business--not philanthropy.

"There can be no mistaking the considerable disagreement that certain intervenors have with the proposal," the applicants concede. Yet they insist there was no other way.

"GridSouth is a joint business venture" they explain, "formed by transmission owners to eventually ... make those businesses more profitable. So long as GridSouth meets the RTO requirements ... the forming transmission owners should have the right to negotiate a structure for their new company that will maximize the value of their transmission assets"

GridSouth sees a regional collaborative process as the enemy to fruitful negotiations. The RTO's three utility sponsors say that such dialogue "tilts the process inexorably against the filing companies, who are expected to compromise without any reciprocal commitment from the other parties"

Moreover, GridSouth staunchly defends its right to force any new members who join the RTO during an "open window" period to pay a 10 percent premium above the initial capital investment incurred by the three founding members, for the right to acquire the same degree of equity ownership.

"This premium," says GridSouth, "merely allows the founders of the company to receive compensation for their `sweat equity.'"

The founders continue, "It is elementary that an investor who buys in at the ground floor--before the business is established--should get a better deal than those who wait until the business is further along"

What's Included

At its core, the GridSouth model retains much of the territorial and functional integrity of its three transmission-owning utility sponsors, requiring market players in the Carolinas to continue essentially to deal with three different regimes: three control areas, three pricing zones, and three separate entities for settling imbalances, managing congestion, and planning grid expansion. The GridSouth applicants defend that design, however, explaining that building a new consolidated control area would be too expensive. (GridFlorida offered the same argument to defend its decision to retain three separate control areas.)

Also, GridSouth adds that neither of the two state public utility commissions in the Carolinas has done much to require retail competition or unbundling, so that the duty to serve remains in both states, with each utility still required to meet statutory requirements for operating and planning their systems to meet the needs of their native load customers.

And for that reason, GridSouth has proposed no centralized power exchange or energy auction market, nor has it offered plans for markets for real-time pricing of imbalances or congestion. No locational marginal pricing. No flowgates or transmission congestion **contract** rights.

According to New Horizon Electric Co-op, GridSouth's scheme for imbalance trading "is merely an after-the-fact billing convention, providing no real-time price signals that are market-based" Many others oppose this scheme. They complain that GridSouth's imbalance "market" will be extremely illiquid and inefficient if the RTO continues as planned to require all market participants to settle imbalances within a single control area. A group of municipal utility interests put it this way:

"A network service customer which is long (a surplus imbalance) in one control area cannot trade those imbalances with itself in another

control are where it is short (a deficit imbalance)"

GridSouth in fact concedes that its proposal falls short of creating a real-time balancing market, but defends it as "a good first step towards the FERC's objective:' GridSouth argues that it would be premature to design such markets until an RTO is in place to ensure grid independence, until state regulators begin to introduce unbundling and retail competition, and until the three utilities transfer ownership of the transmission networks to the RTO--an event which GridSouth admits may not happen anytime soon, if ever.

Each separate utility control area would also function as a separate pricing zone, with rates designed after the popular license-plate pricing model, recovering all transmission plant costs and revenue requirements separately for each utility. The rate structure would include a systemwide "transmission service charge" (TSC--a grid management charge paid by all transmission customers), and would separately calculate a combined revenue requirement for the entire GridSouth zone that would define prices for "through" and "out" service not involving a "sink" located within GridSouth proper.

Again, as has been seen with other proposed RTOs, many GridSouth opponents question why the RTO must collect a systemwide grid management charge if embedded utility-specific revenue requirements are already recovered in license-plate rates for transmission. GridSouth admits to the design:

"The intervenors are correct that grid users will now pay two sets of costs--transmission owner costs and GridSouth costs (the TSC). ... Such costs do not overlap, as some intervenors imply: GridSouth and the transmission owners are wholly separate entities, each with their own costs."

But then comes the more remarkable admission from GridSouth:

"Although it may be rational to expect energy costs to decrease with an RTO, and perhaps for rates per megawatt of transmission to be reduced, the expectation that the overall transmission revenue requirements of the transmission owners will decrease from current levels is an unrealistic expectation in the short-term. (We) are not aware of any existing ISO/RTO member who has filed for a transmission rate decrease since joining an ISO."

And What's Missing

"What is also important," says South Carolina Consumer Advocate Philip Porter, "is who is missing in this RTO; prominently, for example, the South Carolina Public Service Authority."

Of course, even Santee/Cooper admits that the private-use bond restrictions under the Internal Revenue Code and the South Carolina Constitution make it problematic for it to join GridSouth, even though, on a stand-alone basis, the Authority operates 35-40 percent of the transmission lines in South Carolina, covering about 75 percent of the state. In fact, Santee/Cooper was an original signatory (May 1, 1970) to the VACAR agreement (Virginia-Carolinas Reliability Group Reliability Agreement). Many in the Southeast believe that Santee/Cooper (and, by the way, Virginia Power, which has committed to the Alliance transco) should be included as members of GridSouth.

"Were the Authority not a public agency, its participation in the discussions leading up to creation of the GridSouth proposal would not even be a question:' Yet Santee/Cooper still feels it could have been included in some secondary way.

"Within these constraints the Authority can envision the meaningful integration of its transmission facilities with those of GridSouth through a coordination or seams agreement."

Municipal utilities in North Carolina feel the same. They echo the suggestion from Santee/Cooper that all members of VACAR, including Virginia Power, should be members of GridSouth. They continue, "Unlike some other

RTO proposals, the proposed GridSouth arrangements ... offer no practical accommodation of the special tax circumstances of cooperatives and municipalities." By way of comparison, they cite efforts undertaken by the Midwest ISO, which, they say, had proposed to protect cooperatives from additional federal tax exposure by designating the ISO as an agent acting on behalf of members to received funds from transmission customers. The intervenors admit, however, that "the IRS has not yet Tied whether the MISO agency method will spare cooperatives from additional and substantial federal tax exposure"

In the long run, however, GridSouth saw such concerns as other peoples' problems.

"While certain statutory provisions may preclude certain public power entities from joining a for-profit RTO, it would not be fair to require (the) applicants to abandon their desire for a for-profit RTO simply because of statutory restrictions over which they have no control."

Generation Availability

Key to Success?

In a protest against the GridSouth RTO proposal, a group of municipal utilities and rural cooperatives in the Carolinas argues that any successful RTO should be big enough to ensure a wide availability of generation supply from competitive sources. Led by the attorneys Gary Newell, of Spiegel & McDiarmid, and Susan Kelley, of Miller Balls & O'Neill, these parties offer comparisons of generation supply availability among current ISOs and within the territory of the proposed GridSouth RTO, using evidence collected and compiled from various sources, including the Electric Power Supply Association, the U.S. Energy Information Administration, and the RDI NewGen Database.

Table 1: Comparing the Regions Competitive energy supply as share of capacity or peak load.

Sources of Generation Supply	Calif. ISO	PJM	NY ISO	ISO NE	Grid South
Merchant Gen Up By 12/31/2001 (% of peak load, per EPSA)	8.4	6.1	2.5	58.1	4.5
Merchant Gen Existing or Planned (% of peak load, per EPSA)	41.9	28.6	29.6	80.9	4.5
Non-Utility Supply (% of summer capacity rating, per U.S.E.I.A.)	41.4	10	15.4	44.7	5.6

(Source: Electric Power Supply Asso. and U.S. Energy Information Administration. The municipal utilities admit that the figures in Table 1 may be slightly overstated for PJM, but add that such overstatement would disappear if Allegheny Power were to join PJM under the "PJM West" concept, as currently contemplated.)

According to Newall, Kelley, and their clients, the table shows that, with the exception of the New York ISO, merchant generation expected to be on line by the end of this year is available to a much greater extent in every region than in GridSouth. "The difference is even more striking," they say, when one compares for GridSouth and the four ISOs the portion of peak load that would be met by the total of existing and planned merchant

generation shown in the EPSA database.

Table 2: GridSouth In Depth

Shares of Gen Supply: RTO Applicants vs. Third Parties

	GridSouth Application (% Share)	All Other Supplies (% Share)
1. Capacity in Operation	74.29	25.71
2. Capacity Under Construction	39.16	60.84
1 + 2 Combined	75.11	24.89

(Source: Utility Data Institute and RDI NewGen Database.)

Of course, Newall, Kelly and their clients admit that "planned generation" in all of these various regions "may actually never be built." But they counter that concern by noting that the shares of merchant generation described in Table 1 may in fact be understated, since those figures omit divestitures of utility-owned power plants to third parties.

Moreover, they add that the regional discrepancy is likely understated. For example, they note that the EPSA figures for the "merchant gen" sector described in Table 1 do not reflect generation in each region that was built for other purposes but that has since become "merchant" in nature. Second, they add that the EPSA data does not include as "merchant" generation the "substantial number" of generating plants that were built by utilities to serve their franchised loads that were later divested to merchant operators, often in response to state restructuring statutes.

Thus, they conclude that "if divested generation were included in the above compilation, the spread between GridSouth and the four ISOs would be vastly wider than shown in the foregoing table."

"The crucial point," they contend, is not only that the GridSouth applicants dominate the generation market, but that "their dominance is expected to continue into the future."

Source: FERC Docket No. RT01-74-000, Joint Protest on Behalf of Electricities of North Carolina Inc., North Carolina Elec. Memb. Corp., New Horizon Elec. Co-op Inc., Piedmont Mun. Pwr. Agency, Cent. Elec. Pwr. Co-op Inc., and Cities of Orangeburg and Seneca, S.C., pp. 33-39, filed Nov. 20, 2000.

Data Box--GridSouth

NAME: GridSouth LLC

SPONSORS: Carolina Power & Light Co., Duke Energy Corp., South Carolina Electric & Gas Co.

POSSIBLE PLAYERS: South Carolina Public Service Authority (Santee/Cooper)

SIZE: 33,500 MW peak load; 10,000 miles of transmission network covering 65,000 square miles across North Carolina and South Carolina, valued at about $3.07 billion.

STRUCTURE: For-profit limited liability company (transco) that would take on functional operation of grid facilities from the three sponsoring transmission owners. These TOs hold passive (non-voting) interests. No present plans for TOs to transfer grid ownership to transco. Each TO runs its own control area.

GOVERNANCE: Board of Directors (seven seats), plus Stakeholder Advisory Committee ($10,000 initiation fee plus annual fee of $5,000).

MARKETS: Bilateral trading for commodity energy. No power exchange or similar central auction. No real-time markets proposed as yet for ancillary services, imbalances, or congestion management. Participants net imbalances within control area (or settle with others in the same zone) and pay an as-yet-undefined "hourly imbalance charge" (HIC) to GridSouth.

CONGESTION RIGHTS: No apparent tradable financial or physical right to transmission. Congestion is settled administratively within control areas on basis of load-ratio causation of congestion over constrained paths.

RATES AND TARIFFS: Plan will "grandfather" any existing transmission **contracts** executed prior to July 9, 1996. Also preserves traditional status of native load--i.e., any transmission service purchased by a load-serving entity to serve bundled retail load would remain exempt from the RTO tariff. TOs will set revenue requirement within their pricing zones (same as control area), charging license-plate rates, to remain in place through 2006, with a possible rate moratorium during that time. RTO collects a systemwide transmission service charge (TSC). Actual rates to be proposed in mid-February.

KEY ISSUES: (1) Right of TOs as passive owners to "control" board selection and any subsequent equity issues through an IPO. (2) Requirement for late-joining members to pay a 10 percent premium to acquire equity interests. (3) Omission of Santee/Cooper, which controls 35-40 percent of transmission miles in South Carolina. (4) Three separate control areas instead of one. (5) Lack of real-time markets for imbalance trading and congestion management. (6) Right of TOs for right of first refusal to build transmission in their own service territories. (7) TO authority to calculate available transmission capacity and to plan transmission expansion and conduct cost and feasibility studies. But TOs answer that decisional authority remains vested with RTO.

Source: FERC Docket No. RT01-74, as updated through answer filed Dec. 5, 2000.

RTO West: Best in Class?

The Pacific Northwest warms up to public power.

"There is, much to praise here," says Joseph Hartsoe, I Enron s vice president for federal regulatory affairs.

"There is much to like," adds Julie Simon, policy vice president for the Electric Power Supply Association.

Hartsoe and Simon are talking about two separate but overlapping plans to create RTO West, covering the Pacific Northwest, and TransConnect, a for-profit transco, which would become a member of the new RTO. One might surmise from their comments that RTO West and TransConnect will enjoy clear sailing. In fact, quite a few differences will still require ironing out. But overall, the outlook appears bright, since RTO West and TransConnect seem to have overcome the two major roadblocks to transmission restructuring: (1) getting public power on board, and (2) incorporating bundled retail load (native load) into the mainstream of regional market structures.

For example, Enron commends RTO West for "finding a way" for the Bonneville Power Authority (BPA)--a federal power marketing administration (PMA)--to participate together with the region's other transmission owners. As Hartsoe explains, the "good work in this respect should be the basis for requiring all PMAs and the Tennessee Valley Authority to relinquish operation of their transmission systems to an RTO"

And at EPS& Simon sees RTO West as no less than a model for resolving the "black box" of native load: "Today 70 percent to 80 percent of the transmission system in the Northwest is used to serve native load (and) is not subject to the same terms and conditions that apply to other transmission. This discrimination is remedied under the RTO West proposal"

The Players

Six traditional, transmission-owning utilities have proposed to form TransConnect, a stand-alone, for-profit transmission company, or transco. (See "Data Box--RTO West.") That group plus three added companies have applied to form RTO West, which would function as a not-for-profit ISO, operating transmission owned by third parties across an area including all of the Northwest Power Pool, plus the Nevada Power service territory--covering all or parts of eight states.

In two separate cases filed at the FERC, these two groups have filed their so-called "Stage One" plans, which specify terms and conditions for (1) RTO and transco governance (selection and qualification of board

members), (2) RTO size and scope, and (3) some details on liability agreements, and (4) transmission planning and expansion. However, most of the details regarding rates, markets, and grid operation, including lists and maps of flowpaths, and specific protocols for settlement of imbalances and congestion, and allocation of firm transmission rights (FTRs), are left to Stage Two documents, set to be fried in the spring.

This two-step plan has produced much of the friction to date.

Enron, EPSA, and Dynegy argue that if the RTO is to be considered as truly independent of markets, as required by FERC Order 2000, then the RTO filing utilities should put their proposed stakeholder board of trustees in place as soon as possible, so that it's the RTO board and managers--and not the filing utilities--who develop the details of tariffs and pricing. As Julie Simon explains, such an approach ensures that the Stage 2 details will "have the imprimatur of the independent board and management of RTO West."

Yet the utilities balked at this suggestion in their answer filed on Dec. 5.

"Substituting the RTO West board of trustees for the filing utilities would come at a high price in the form of delays," say the utility sponsors of RTO West. They see this suggestion as an attempt to gain reconsideration of issues already decided. "This process," they say, "realistically could not be completed before spring 2001."

Grid Planning and Expansion

Perhaps the single most contentious issue contained in the Stage 1 plan is the proposal by TransConnect asking the FERC for authority to file tariffs for performance-based rates (PBR) or other incentives to help the transco undertake responsibility for transmission planning and expansion. Many parties say this request violates FERC Order 2000. They say that RTOs must dictate grid planning and expansion, and that only RTOs--not transmission owners--can file tariffs for transmission service pricing (though transmission owners can determine costs and revenue requirements associated with such rates).

The comments of the Public Power Council are typical:

"The TransConnect motive is transmission-oriented, thus distorting price signals and introducing bias in favor of transmission at the expense of non-transmission but cost-effective solutions to resolving congestion, or other planning problems such as demand-side management and generating siting."

The disagreements arose apparently because the RTO working groups could not agree on whether the RTO should play only a "backstop" role in grid planning, acting as the guardian of reliability, or an active role to ensure that market forces govern the process. Consider the comments of a group of energy efficiency advocates, including the Northwest Energy Coalition, and the Natural Resources Defense Council:

"From the beginning" say the advocates, "the issue of where responsibility should lie for making expansion decisions flip-flopped between two basic alternatives:

* Market Approach. The RTO essentially needs to send good price signals and then help coordinate and assist.... Proponents of this view ... feared that an activist RTO with the ability to socialize costs ... would preempt and inhibit the market.

* Backstop Approach. The market may not work quickly enough to avoid disastrous situations.... Thus the RTO must have the ultimate authority to fund projects to keep the lights on."

In fact, some question why the filing utilities decided in the first place to seek FERC certification regarding the functions and "independence" of the stand-alone transco known as TransConnect. For example, the Utah Associated Municipal Power Systems insist that TransConnect (albeit a large company) will carry the same legal status as any other transmission-owning utility that participates within RTO West:

"The TransConnect proposal plainly is not a `compliance filing' required by order 2000.... Given that TransConnect is not intended to be an RTO, it is not clear why the FERC should concern itself that utility's alleged `independence.' ... It would be entirely inappropriate to allow one for-profit transmission company within the RTO West umbrella to make its own unilateral decisions about what transmission expansion decisions would best serve the region and then demand recovery of those costs through RTO West rates?'

The Canadian Connection

Electric links with Canada create unique issues for RTO West. Consider TransAlta Corp., for example, which participated extensively in the discussions that took place last year and led to the RTO West plan.

In comments filed in November, TransAlta noted that market participants in Alberta seeking to gain access to electric markets in the U.S. Pacific Northwest are "highly dependent" upon grid facilities owned and operated by the British Columbia Hydro and Power Authority, and urged the FERC to do all in its power to encourage BC Hydro to participate in RTO West.

The Alberta Power Pool endorses that view:

"While both Alberta market participants and those in the Pacific Northwest desire to enhance ... cross-border trade in electric power, they are currently entirely dependent on BC transmission facilities for access.

"A key element is that all corridors, including the U.S./BC/Alberta corridor be made fully viable for competitive access in both directions.... Alberta considers this a critical mission."

Meanwhile, however, BC Hydro has many reservations. It questions whether RTO West will offer enough firm transmission rights (physical rights keyed to flowpaths) to create a liquid market, and wants RTO West to create a bidding system for unused FTRs. It also questions why RTO West has decided not to take control over all lines at transmission-level voltages within the RTO area, and apparently wants RTO West to do more to provide incentives for public power to join, such as rights to convert existing **contracts** during the RTO's first year to higher priority service.

More importantly, however, BC Hydro takes issue with the RTO's proposed Agreement Limiting Liability, arguing that it will not mesh well with Canadian efforts to develop an independent grid operator (BC IGO) in British Columbia.

"The (agreement) does not address the liability and insurance issues associated with the coordination of RTO functions and services between RTO West and BC IGO" says BC Hydro.

"The (agreement) assumes that Canadian participants will enter into direct **contractual** relationships with RTO West, whereas under the agreed-on framework, Canadian participating transmission owners will have **contract** privity with ... BC IGO, which in turn will **contract** directly with RTO West."

A Mission to Serve

While RTO West has won plaudits, some question whether the benefits are worth the costs. In particular, RTO West would operate a single control area, prompting many to compare it with the California ISO, which is known for spending millions to build its own brand new control center.

One critique comes from a group of industrial customers that includes Alcoa, Kaiser Aluminum, Boeing, Boise Cascade, BP-Amoco, Hewlett-Packard, Kimberly-Clark, International Paper, and Weyerhaeuser. They cite the RTO's projections for $82 million in startup costs and, and in particular the $63 million budget for annual operations. "This estimate is ... in the range of 20 percent of California ISO costs.... These estimates are extremely optimistic."

A group of consumer-owned utilities from Idaho agrees: "The operating costs of the California ISO, which operates a transmission system roughly equal in size to the system RTO West would operate, are in the

range of $225 million per year."

Perhaps the real guarantee of consumer benefits lies in crafting the proper corporate mission statement for RTO West. That's the advice offered by David Warren, director of the Office of Trade and Economic Development of the state of Washington.

As Warren thumbed through the bylaws, he noticed that RTO West pledged only to make the FERC happy. As stated in Article III, the bylaws defined the purpose of the RTO West as "to serve as an RTO for the RTO West geographic area in accordance with the applicable requirements of FERC" By contrast, Warren suggested that the RTO should serve a higher authority. He recommended a new mission statement:

"The purposes of the corporation are to serve the public interest by reliably operating the high-voltage transmission system ... at the least cost to society ... and by carefully balancing the various economic and non-economic interests...."

Warren. explained his idea:

"(O)ne hopes that an organization on which so much effort is being expended has more purpose than simply to fulfill a regulatory mandate."

Winning Bonneville's Trust

Should that require special dispensation?

ENRON HAS PRAISED RTO WEST for attracting the Bonneville Power Administration as a concurring party.

YET ENRON OPPOSES THE PLAN TO GIVE PREFERENCE to requests for transmission service to service certain loads in the Pacific Northwest. RTO West proposes such a preference to allow BPA to participate in the RTO without violating federal laws that give preferences to public power entities to hydropower from from federal projects.

ENRON FORSEES A "PERNICIOUS BALKANZING EFFECT" on regional power supplies and argues that the preference will force the RTO to discriminate. According to Enron, "the contention that a regional preference is legally required is both at war with this nondiscrimination mandate and demonstrably false. For several years," Enron explains, "BPA has offered an open-access transmission tariff containing no similar regional preference."

AND OTHERS QUESTION whether consumers will benefit from creation of a new RTO with Bonneville as a key player:

"THE BENEFITS OF AN RTO ARE LIKELY TO BE SMALL because Bonneville already captures much of the benefit."

--Idaho consumer-owned utilities

"LONG BEFORE THE ENERGY POLICY ACT OF 1992, northwest transmission owners substantially operated the grid on a common-carrier basis.... BPA has been required to make surplus federal transmission capacity available to other users on a fair and non-discriminatory basis."

--William Patton, utilities section director, office of Seattle city attorney

"BONNEVILLE OWNS APPROXIMATELY 75 PERCENT of the high-voltage transmission system (230-kV and above) in the Pacific Northwest and nearly 50 percent of such facilities in the RTO West geographic area.... Given the dominance of Bonneville.... the RTO is likely to produce little, if any benefit in terms of constraining monopolist market power in this region."

--Idaho consumer-owned utilities

Data Box--RTO West

(Note: Stage 2 plans filed this spring to offer more details on tariffs, markets, and grid operation.)

NAME: RTO West

SPONSORS: Avista Corp.*, Bonneville Power Administration (concurring party), Idaho Power Co., Montana Power Co.*, Nevada Power Co.*, PacifiCorp, Portland General Electric Co.*, Puget Sound Energy Inc.*, Sierra Pacific Power Co.* (*--Denotes companies also proposing to form a standalone, for-profit transmission company, TransConnect, that would become a member of RTO West.)

SIZE: Covers Washington, Oregon, Idaho, Nevada, Utah, most of Montana, plus parts of Wyoming and California. Equivalent to Northwest Power Pool plus territory of Nevada

STRUCTURE: Not-for-profit ISO. (TransConnect is a for-profit transco.) Transmission owners hold passive voting interests. (Tentative ... plans by TransConnect to allow utility members that divest transmission to the transco to acquire "Class C" voting stock as "transmission-dependent utilities.")

GOVERNANCE: Board of Trustees, chosen by 30-person selection committee, in turn selected by vote of six-person stakeholder committee with TOs holding two of six seats.).

MARKETS: Bilateral trading for commodity energy. No power exchange or similar central auction. No real-time markets specified as yet for ancillary services, imbalances, or congestion management. Proposes zonal-based, real-time balancing market.

CONGESTION RIGHTS: Physical, tradable firm transmission rights (FTRs) keyed to flowpaths. Customers scheduling across flowpaths must have FTRs, non-firm rights, or rights under pre-existing **contracts** . Zonal FTR auctions proposed.

RATES AND TARIFFS: License-plate pricing with company-specific zones, in place until 12/14/2011. Tariff to cover service formative load. Possible import/export charge to "through" or "in/out" service.

KEY ISSUES:: (1) Authority of TransConnect over grid planning and expansion. (2) Allocation of FTRs to take account of load growth. (3) TransConnect plan for members that divest transmission to convert equity interest to Class C voting shares reserved for transmission-dependent utilities. (4) Exclusion/inclusion of Nevada Power service territory. (5) Failure of RTC) to extend control to all transmission facilities. (6) Who finalizes Stage 2 plan--new board or filing utilities? (7) Terms and conditions for suspension of existing transmission **contracts** , including compensating transfer charges. (8) Rollover rights for large number of "through" **contracts** signed during last two years. (9) Regional preference encouraging BPA participation. (10) RTO attempts to protect sanctity of PUC-ordered stranded cost surcharges. (11) Monetary liability for wrongful dispatch. (12) Whether FERC should consolidate TransConnect application with RTO West.

Source: FERC Docket Nos. RT0 1-15, RT01-35, updated through answers filed Dec. 5, 2000.

Bruce W. Radford is editor-in-chief at Public Utilities Fortnightly.

INDUSTRY CODES/NAMES: BUSN Any type of business; OIL Petroleum, Energy Resources and Mining; TELC Telecommunications
DESCRIPTORS: Electric power distribution--Analysis; Electric utilities--Analysis; Interconnected electric utility systems--Analysis; Deregulation --Electric utilities
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5/9/2 (Item 1 from file: 348)
DIALOG(R)File 348:EUROPEAN PATENTS

00300347
Asynchronous multiphase switching gear.
Asynchrones mehrphasiges Schaltgerat.
Appareil de commutation polyphase asynchrone.
PATENT ASSIGNEE:
International Business Machines Corporation, (200120), Old Orchard Road, Armonk, N.Y. 10504, (US), (applicant designated states: DE;FR;GB)
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PATENT (CC, No, Kind, Date): EP 313926 A2 890503 (Basic)
EP 313926 A3 900530
EP 313926 B1 930804
APPLICATION (CC, No, Date): EP 88116981 881013;
PRIORITY (CC, No, Date): US 113926 871027
DESIGNATED STATES: DE; FR; GB
INTERNATIONAL PATENT CLASS: H02J-003/38; H02J-009/06;
CITED PATENTS (EP A): US 4667116 A; US 3942028 A; US 4475047 A; US 3906335 A; DE 2039779 A

ABSTRACT EP 313926 A2
An asynchronous multiphase switching method and apparatus are disclosed which transfers a system load between two asynchronous AC power sources in an improved manner. It operates as a make-before-break switch to provide uninterrupted power to the system load during the transfer while minimizing voltage and current fluctuations. The control circuitry allows energy to be supplied to the load during the transition without allowing current to flow between the power sources. A matrix of SCRs is used to transfer the load between the two power sources. The switches to be gated are determined by the relative timing relationships of the existing and takeover voltage waveforms. By altering the pattern of the switches which are gated and by controlling the direction of energy flow, the transition can be made between the power sources without interruption of power.
ABSTRACT WORD COUNT: 139

LEGAL STATUS (Type, Pub Date, Kind, Text):
Application: 890503 A2 Published application (A1with Search Report ;A2without Search Report)
Examination: 891004 A2 Date of filing of request for examination: 890809
Search Report: 900530 A3 Separate publication of the European or International search report
Examination: 920408 A2 Date of despatch of first examination report: 920225
Grant: 930804 B1 Granted patent
Change: 931006 B1 Representative (change)
Oppn/None: 940727 B1 No opposition filed
LANGUAGE (Publication,Procedural,Application): English; English; English
FULLTEXT AVAILABILITY:
Available Text Language Update Word Count

CLAIMS B	(English)	EPBBF1	1706
CLAIMS B	(German)	EPBBF1	835
CLAIMS B	(French)	EPBBF1	1023
SPEC B	(English)	EPBBF1	7612
Total word count - document A			0
Total word count - document B			11176
Total word count - documents A + B			11176

SPECIFICATION EP 313926 B1

The invention disclosed broadly relates to the switching of multiphase electrical power sources and more particularly relates to asynchronous multiphase switching techniques.

Military power systems require frequent switching of the system load between several AC power sources. Aircraft switch from ground power to on board power prior to takeoff. The computerized electronic systems are often required to operate without power interruptions through this switching activity. Submarines, due to operational drills or casualty situations, need to alternate between their port and starboard power sources. This activity must not disrupt critical navigational, weapons, and sonar systems.

AC power sources cannot be paralleled unless the characteristics of the alternators are similar and operated at the same speed and voltage ratings. To allow paralleling, the power sources also have to be aligned electrically so that their respective phases can be tied together. If the speed or angle of rotation between each alternator is not exact, the machines will try to force each other into synchronism. This is an abrupt action as the rotating masses of the alternators cannot change speed instantaneously. The machines will nevertheless try to get into alignment as quickly as possible. The chances for the alternators to damage each other or physically break free from their moorings is very great especially when large unsynchronized machines are paralleled.

If the output voltages of the alternators are not equal, the one with the higher voltage will "hog" the load, making the sharing of demand difficult and causing poor utilization of the equipment. These difficulties cause the process of paralleling alternators to be a sensitive operation, especially with machines larger than several kilowatts. For this reason, system load **transfers** between **power** sources **have** required **that** the old power source be disconnected before the new power source is connected. This break-before-make switch causes power dropouts for significant time intervals, seriously impacting the system load.

Previously, reliance on fast recovery computer systems has tried to reduce exposure to this weakness on the platform. With low conversion efficiencies, conversion of the AC power to a common DC grid, and then inversion back to AC becomes prohibitive as the power handled increases. The batteries and switching equipment necessary to implement such a conversion/inversion occupy too much space and increase the overall weight greatly. Cooling the conversion equipment becomes an additional concern as the efficiency losses are given up as waste heat.

DC "auctioneering" or switching between two power sources is somewhat easier. However, redesigning equipment to operate off of DC power sources often requires great expense and renders older equipment obsolete. Control and switching of DC power also increases the complexity and size of hardware design and this impact limits the conversion of older equipment to DC.

What is needed is uninterrupted power switching provided by a new method not requiring synchronous power sources.

It is therefore an object of the invention to transfer, without interruption, a load between sources that are not synchronous, so as to allow for differing frequencies, differing voltages and differing phases

between the sources.

It is another object of the invention to detect and inhibit a reverse phase operation of a switch.

It is yet a further object of the invention to monitor current and voltage so as to allow switching loads with large reactive components.

It is still a further object of the invention to monitor line voltage of both sources and to switch those sources, if needed, or alternately, to inhibit a switching event if a new source is out of tolerance.

It is yet a further object of the invention to actively switch one line at a time so as to assure power continuity without tying the power buses together or allowing reversed current to occur.

It is yet a further object of the invention to actively switch line-by-line the load to a new power source so as to allow alignment between the power sources, thereby achieving automatic line swapping, permitting the alignment of two, three phase power sources.

It is still a further object of the invention to provide automatic one-way transfers to limit or control **self power** seeking operations.

It is still a further object of the invention to minimize electrical stress on the load or power sources by providing a make-before-break switching function without having a back electromagnetic force reaction which may damage or stress the sources or loads.

It is yet a further object of the invention to provide for a fault detection and blocking function so as to isolate faulted loads and avoid switching such faulted loads to other power sources.

It is still a further object of the invention to allow the switching of sensitive loads at a speed sufficient to eliminate a power dropout, so as to prevent the need for expensive backup power systems.

These objects are solved in advantageous manner basically by the present invention as laid down in the main claims.

The asynchronous multiphase switch gear (AMSG) implements a new method for transferring a system load between two asynchronous AC power sources. The power sources are assumed to be similar in voltage, frequency, phase rotation, and phase configuration (wye/delta). The AMSG is a make-before-break switch that provides uninterrupted power to the system load **during** the **transfer** while minimizing voltage and current jitter. Make-before-break switching could previously be used when paralleling AC sources to a load only if both power sources were first driven into synchronization.

Electronic switching of power sources in a make-before-break manner requires bridging the load between the old and new sources simultaneously. This "energy bridge" must be carefully designed to direct power to the load without allowing the sources to influence each other. The control circuitry must be designed to allow energy to be supplied to the load, without allowing current to flow between the sources.

The AMSG was designed using silicon controlled rectifiers (SCRs) as switching elements. SCRs provide high peak power handling capability, and exhibit low conduction losses. The SCRs act as unidirectional valves between the power sources and the load. By controlling the SCRs at precise moments in time, it becomes possible to share the load between the two sources without tying them together.

During the period of switching between the two power sources, the SCRs are used as diode switches, conducting in a unidirectional manner. Thus, back-to-back SCRs effectively "dot or" the two AC sources to the load. The highest voltage source feeds the load until the phases commutate, at which point the current required from the old source is reduced to zero and its SCRs turn off (become nonconductive). This process occurs on a phase-by-phase basis until the total load power is taken from the new source.

Prior to connecting the load to a power source, the voltage amplitude and phase rotation of each source are checked to be within specified

limits. Only then will gate control signals be provided to the appropriate SCRs to allow energy conduction to the load. The initial application of power to the load is a straightforward phase-to-phase switching operation. The selected power source is simply connected to the load terminals.

A matrix of SCRs is used to transfer the load between the two **power** sources. The switches to be gated are determined by the relative timing relationships of the old and new voltage waveforms. Altering the pattern of the switches gated and controlling the direction of **energy flow** , allows jumping, without power interruption, between separate sources.

The AMSG chooses one phase voltage at the load to be compared with the new sources' phase voltages. The angular displacement between the load phase and the closest new source phase will be a maximum of 60 degrees relative to the load phase, +/- any error due to a slight differences in frequency. Therefore, when **transferred** between **power** sources the load **will** never **see** a voltage or current jitter greater than approximately a 60 degree shift.

The AMSG is controlled by a microprocessor which selects the SCR diodes to be gated during a load transfer and also determines the best match between the load phase and the new source phases. Operation of this smart switch allows selection of the proper SCRs prior to the transfer. By looking ahead, no time is required to compute an SCR matrix solution. This is necessary, for in the event of a failure of the old power source, there would be no waveform available to compare the old source with.

In the following description the invention is explained in more detail. In the drawing the figures show in brief description the following:

Fig. 1 a functional block diagram of the invention.
Fig. 2 a three phase voltage source.
Fig. 3 the phase-to-phase voltage V(sub(AB)).
Fig. 4 the phases of source 1 and the phases of source 2 which are not aligned in time, therefore the sources are not synchronized.
Fig. 5 the voltage and current in phase for Q equals 1.
Fig. 6 the current leading the voltage where the power factor Q equals the cosine ((phi)).
Fig. 7 the current lagging the voltage where the lagging power factor Q equals the cosine ((phi)).
Fig. 8 a schematic diagram of an SCR bank network.
Fig. 9 a schematic diagram of the three valid SCR bank connection configurations.
Fig. 10 a circuit diagram of parallel and opposed SCRs allowing bidirectional current control.
Fig. 11 an illustration of the phase difference variation over time for a single phase between two, three phase sources with different frequencies.
Fig. 12 the three phase voltage source where each vertex of a triangle corresponds to one of the phases A, B or C.
Fig. 13 shows for which two phases the voltage is measured between.
Fig. 14 a graphical representation of how a source is connected to a load.
Fig. 15 the two power sources connected to the load.
Fig. 16 that only the old SCRs that were conducting will remain on.
Fig. 17 the example of Case 1.
Fig. 18 the example of Case 2.
Fig. 19 the example of Case 3.
Fig. 20 the example of Case 4.
Fig. 21 the example of Case 5A.
Fig. 22 the example of Case 5B.

Fig. 23 the example of Case 6.
Fig. 24 the example of Case 7.
Fig. 25 the example of Case 8.
Fig. 26 the example of Case 9A.
Fig. 27 the example of Case 9B.
Fig. 28 the waveform coincidence detector circuit.
Fig. 29 a schematic diagram of the control unit.
Fig. 30 a schematic diagram of one of the two SCR banks.
Fig. 31 a flow diagram of the transfer on the detection of an event.

The asynchronous multiphase switch gear invention is shown in the functional block description of Fig. 1.

1. SOURCES 1,2

Each power source in this specific design is a 480 V (+/-10%), 60 Hz (+/-5%), three phase delta. A three phase power source is comprised of three identical sine waves, with a phase shift of 120 degrees between each waveform. the three sine waves correspond to three voltages (see Fig. 2).

A delta power source has three nodes or "legs," with one voltage between each pair of legs. In a delta power source, there is no ground reference; the voltage between each pair of legs (the phase-to-phase voltage) is the sum of the absolute values of the two voltages (see Fig. 3).

In Figs. 2 and 3 the sine waves are labeled as phases A, B, and C. As time advances from 0 to T1 the phases occur in the order A-B-C. Beyond T1, this order continues to repeat: A-B-C. This sequence is defined as the phase rotation of the power source. In Fig. 2, the phase rotation is A-B-C-A-B-C-A, etc. When providing power to a device such as a motor or a pump, whose operation depends upon mechanical rotation, it is crucial that the order of phase rotation be maintained. This will be an important point later in the discussion of transferring a load between two independent sources.

In the functional block diagram of Fig. 1 the phases are labeled A, B and C on source 1, and A(min), B(min) and C(min) on source 2. The phase rotation of source 1 is A-B-C-A-B-C-A, etc. The phase rotation of source 2 is A(min)-B(min)-C(min)-A(min)-B(min)-C(min)-A(min), etc. The power sources are independent of each other: the phases of source 1 are not necessarily aligned in time with the phases on source 2 (see Fig. 4).

Normally, only one power source supplies energy to the load at any given time. When the load is **transferred** from one **power** source to **the** other, the **power** source that supplies energy to the load before the time of transfer is called the "old" source. **The power** source that the load is **being transferred** to is called the "new" source.

2. LOAD

The intended load in this specific design requires uninterrupted power and cannot tolerate peak phase-to-phase voltages below 108 V for more than 50 microseconds. The load phases are labeled as L1, L2, L3. Power phase rotation at the load is L1-L2-L3-L1-L2-L3-L1, etc.

The load may have capacitive or inductive elements, causing a leading or lagging power factor up to 0.8.

The power factor Q is defined as the cosine of the angle between a voltage and its associated current. For a purely resistive load the current waveform is in phase with the voltage (power factor equals 1.0 as in Fig. 5). For a capacitive load the current leads the voltage as in Fig. 6, and for an inductive load the current lags the voltage (see Fig. 7).

3. SCR BANK 1,2

Each SCR (silicon controlled rectifier) bank (SCRB) connects the three load phases to one of the two power sources (see Fig. 1 - functional block diagram). Each SCRB contains nine lines which interconnect each

phase of the power source to every phase of the load (see Fig. 8). At any given time, only three of the nine lines are conductive. This allows the three phases of the power source to be connected to the three phases of the load in several different configurations, however, only three of these configurations are valid (see Fig. 9). These are the three configurations that maintain the phase rotation between the power source and the load. For example, suppose we wish to connect phase A of the power source to phase L2 of the load. We know that at the power source, phase B follows phase A, and that at the load, phase L3 follows phase L2. Therefore we connect phase B to phase L3. Similarly, we know that phase C must be connected to phase L1. This is configuration 2 shown in Fig. 9.

The lines to be selected are determined by the control unit (section 11) and driven by the SCR driver (section 4). A line can be gated to conduct energy either unidirectionally or bidirectionally. This bidirectional current control is accomplished by individually controlling two parallel and opposing SCRs on each line (see Fig. 10). An SCR requires a low energy gate signal to make it conductive. Once triggered, an SCR will conduct current with no further need for the gate signal. To turn off an SCR, the gate signal must be absent and the current through the SCR must be reduced to some minimum value. This minimum current needed to support conduction is called the sustaining current and is typically a few percent of the SCRs' rated current.

Fig. 30 is a more detailed circuit schematic diagram of the SCR bank, showing the interconnection of the 18 SCR devices in one bank for configuration 1, configuration 2 and configuration 3, corresponding respectively to the path descriptions shown in Fig. 9 for configuration 1, configuration 2 and configuration 3. The nodes A, B and C for each configuration in Fig. 30 are connected in common and the nodes L1, L2 and L3 for each configuration are connected in common. By selectively applying a gate drive signal on the gate input line for a respective SCR device, the SCR device will be rendered into a conductive state as has been previously described.

4. SCR DRIVER 1,2

Each SCR driver (SCRD) provides the gate drive signals to the SCRs in one of the SCR banks (SCRB). The drivers are optically coupled to provide high electrical isolation. The SCRD receives its SCR gate driving scheme from the control unit (section 11).

During normal operation, one power source is connected to the load and the SCRD is driving six SCRs; one for the two directions on each of the three gated lines in the SCRB. The driver switch (section 10) activates the SCRD selected by the control unit or toggles the SCRDs to cause a load **transfer** from one **power** source to the other.

5 . COINCIDENCE DETECTOR

The coincidence detector (CD) is a part of the SCR steering mechanism. The CD continually monitors the phase relationship between the voltages on the new power source and the load.

The CD receives the three phase voltages A, B and C from both power sources and one phase voltage from the load (designated as the "master waveform"). The control unit selects one of the two power sources (the new power source) to be compared with the master waveform. The CD determines which one of the three new voltage waveforms most closely matches the master waveform. The control unit utilizes this information to determine which of the three connection configurations of Fig. 9 (see section 3) is the most favorable to engage should a transfer between the two power sources be initiated. This determination is constantly **updated** , allowing load **transfers** to be made instantaneously, since no additional processing is needed when the transfer is initiated.

The CD is necessary because **the** two **power** sources are not always synchronized. This lack of synchronization may exist because the frequency and loading of the power sources are independent. The frequency

of each source may vary independently by as much as +/- 5%. As time progresses, a frequency difference between the two power sources will cause a varying phase difference between the voltage waveforms of the two power sources (see Fig. 11).

When a **transfer of** the load from one **power** source to the other is initiated, it is necessary to maintain the three voltage waveforms and the phase rotation of the load. The phase rotation of the load and new source are known from the phase rotation detector (see section 7), and the CD has selected the new phase which most closely matches the load master waveform. This provides the control unit with all of the information necessary to choose the most favorable connection configuration.

As an example, suppose that the load phase rotation is L1-L2-L3-L1-L2-L3-L1, etc., and the new power source phase rotation is A-B-C-A-B-C-A, etc. Also suppose that the load master waveform corresponds to phase L1 and it has been determined that this master waveform most closely matches phase C on the new source. We then connect L1 to C, L2 to A, and L3 to B at the time of transfer (refer to Fig. 9).

A specific example of a waveform coincidence detector is shown in Fig. 28. It uses voltage zero crossovers to toggle an up-down counter and select the smallest relative phase difference.

Coincidence Detector Circuitry

To determine the phase relationship between the two power sources, a timing device can be used to monitor the voltage zero crossover points. The master wave at the load (see section 5) is used as a reference sine wave voltage. The points where this waveform crosses through zero volts are digitally compared with the three voltage waveforms of the new source. The waveform with the zero crossover point nearest to the master waveform's, is the closest match.

In order to determine the nearest zero crossover, a gated up-down counter is used. Each time a new source phase voltage crosses through zero from negative to positive, the counter is started counting up and the phase is stored in the phase memory. If the next negative to positive zero crossover is by another new phase voltage, the counter is reset and started again. If the next negative to positive zero crossover is by the master waveform, the counter is reversed and starts to count down.

Following the master waveform zero crossover, the next negative to positive zero crossover will be by one of the new phase voltages. After the up-down counter's direction has been reversed, the next new phase voltage to cross over zero from negative to positive causes the counter to be stopped and the count is sampled. If the count is greater than zero, the waveform that stopped the counter is the closest match to the master waveform. If the count is less than zero, the last waveform that crossed zero from negative to positive before the master waveform is the closest. If the count is zero, both of the new waveforms are equally close to the master waveform.

When the count is sampled, the counter is reset and begins counting up, and the phase is stored. This process allows the closest new waveform to be determined once every cycle.

6. CURRENT SENSOR 1,2

The current sensors (CS) (labeled "I Sense" in Fig. 1) monitor the sense (+/- or 0) of the three phase currents on each power source. This information is provided to the control unit (section 11).

Since the AMSG is a make-before-break switch, care must be taken not to tie the old and new power sources to the load in such a manner that current is able to flow between the power sources.

Allowing each phase leg on the new power source to conduct only in the same direction as the phase leg on the old power source that it is replacing, eliminates the problem. As soon as the current in the old phase leg goes to zero (the old SCR turns off), the remaining SCR on the

new phase leg is driven on, as will be described in the section on operation of the invention (operation).

7. PHASE ROTATION DETECTOR 1,2

One phase rotation detector (PRD) monitors the phase rotation on each power source. The PRD is used before the load has been powered up (both power sources are disconnected). A reversed phase rotation indicates a serious fault, such as the miswiring of an alternator circuit. In this case, the fault would need to be corrected before operation could proceed.

The PRD sends a phase rotation good/bad signal to the control unit (section 11). The control unit prohibits a power source from being connected to the load if its rotation is reversed.

8. GO/NOGO 1,2

Each go/nogo unit (GNG) monitors the three phase voltages of its associated power source and provides a voltage go/nogo signal to the control unit (section 11). If the peak voltage of a power source is below a certain threshold level, the GNG unit signals a nogo state for that power source. If the peak voltage of a power source is at or above the threshold, the GNG unit signals a go state. The control unit interprets the voltage go/nogo signal as indicating whether or not the load can be connected to that power source (see section 11B).

9. EVENT DETECTOR 1,2

The event detector (ED) monitors the three phase voltages at the load terminals. An "event" is defined as a power failure due to the voltage dropping below a certain threshold level, which may happen in one of three ways. The voltage may show a sudden reduction on all three phases, the voltage on a single phase may be lost completely, or the voltages on all three phases may begin to gradually decay or "droop."

A sudden reduction would be caused by the tripping of a breaker, the loss of a phase could be caused by a wiring fault, and the decay of voltages would occur if the generator began to wind down as the result of some prime mover failure.

The ED provides an event signal to the driver switch (section 10) and the control unit (section 11). This signal initiates an automatic load **transfer** between **power** sources if an event is□detected□ . The□control□ unit has the ability to enable and disable the ED.

10. DRIVER SWITCH

The driver switch (DS) activates the selected SCR driver (SCRD). This selection is made by the control unit (section 11). The event detector (ED) can toggle this selection when enabled by the control unit. Only one SCRD is active at any given time, and the DS informs the control unit of the currently active SCRD.

The control unit makes SCRD selection by telling the DS which SCRD to activate (see section 11B). When the ED is enabled, the event signal from the ED to the DS acts as a toggle, causing the DS to activate the new SCRD and deactivate the old SCRD.

11. CONTROL

The AMSG control unit functions are provided by a microprocessor shown in Fig. 29 and are grouped into four categories: SCR selection, driver switch control, transfer recovery, and manual operation.

Fig. 29 illustrates the microprocessor of the control unit. The microprocessor includes a CPU chip such as an Intel 8080 eight-bit processor connected by means of a common bus to a random access memory (RAM) and a read only memory (ROM). Also connected to the common bus is a keyboard and an input/output (I/O) unit which enables the communication between the control unit and the various elements shown in the system block diagram of Fig. 1. The functions of SCR selection, driver switch control, transfer recovery and manual operations are embodied as encoded instructions which are stored either in the ROM or the RAM and are executed as appropriate by the CPU, to enable the intercommunication

through the I/O unit to the balance of the elements in the system of Fig. 1. In manual operation, the operator can make data entry at the keyboard which is then stored in the RAM for supplying operational parameters and other information necessary to carry out customized **power transfer** operations. As will be described later, **the programs** of stored instructions carry out operations such as the transfer on detection of event which is illustrated in the flow diagram of Fig. 31. The signals input to and output from the I/O unit are typically digital signals which are converted by analog-to-digital and digital-to-analog converters for appropriate interfacing with analog components in the system of Fig. 1.

A. SCR Selection

The control unit provides the steering signals to the SCR drivers (SCRD). For the old power source, the control unit selects bidirectional SCR gating for the particular connection configuration. For the new power source, the control unit selects unidirectional SCR gating for the appropriate connection configuration.

The control unit determines the appropriate connection configuration for the new power source from information provided by the coincidence detector (CD), and determines the SCR gating direction from the current sensor (CS). The CD tells the control unit which phase on the new source most closely matches the master waveform at the load. Each of the three master-to-new-phase matches, corresponds to one of the three possible connection configurations (refer to Fig. 9).

The CS tells the control unit the direction of the current on each line of the old power source's connection configuration. The control unit enables only the SCRs on the lines of the new power source connection configuration which correspond to the direction of the current on the old power source legs.

B. Driver Switch Control

The control unit selects the SCRD to be activated by the driver switch (DS). If a power source is not in the go state (see section 8), or if its phase rotation is reversed (see section 7), its SCRD will not be selected (i.e. the source will not be connected to the load).

At load power up, a preferred power source may or may not be designated by the manual control. If a preferred source has been designated, the control unit selects that source's SCRD if and when the source reaches the go state. If the source is already in the go state, the selection occurs immediately. If neither power source has been designated, the control unit selects the SCRD of the first power source to reach the go state, or a predetermined power source if both sources are already in the go state.

The control unit enables the event detector (ED) only when both power sources are in the go state, allowing **a** load **transfer** from the old to new **power** source **if** an event occurs. When a□load transfer□takes place due to an event, the control unit is informed via the event signal from the ED and disables the ED from initiating further transfers until it is manually reset (see section 11D). This is done because a power source which has gone bad may appear to recover when the load is disconnected. A transfer back to this source would be undesirable.

C. Transfer Recovery

The control unit identifies the old **and** new **power** sources by looking at which SCR driver (SCRD) is activated. This information is provided to the control unit by the driver switch (DS). The power source whose SCRD is currently activated is the old source, and the power source whose SCRD is not activated is the new source. The control unit selects the new power source for comparison with the master waveform in the coincidence detector (CD). The control unit also looks at the old power source's current sensor (CS) information to determine the SCR gating direction on the lines of the new source's connection configuration (see section 11A; operation).

When a load **transfer** between **power** sources occurs, the old and□new□ sources **are** swapped. Consequently, the "new" new source is automatically selected by the control unit for comparison to the master waveform. The control unit will also begin to utilize the "new" new source's CS information to determine the appropriate SCR gating direction.

When an event signal originates a load **transfer** between **power** sources, the control unit is **initially** driving **only** one SCR on each leg of the new source's connection configuration. The control unit waits for the current in each leg of the old connection configuration to go to zero before it drives the remaining SCR on the corresponding new leg (see section 6; operation). In addition, the control unit disables the event detector (ED) (see section 11B).

D. Manual Operation

The control unit may receive operating instructions from the manual control (MC). Before load power up, the connection of the load to a power source is arbitrated by the MC. Through the MC, a preferred power source may or may not be selected (see section 11B). The MC can also initiated load **transfers** between the **power** sources. Manual load transfers□are□ allowed at **any** time, regardless of the status of the power sourced (see section 11A).

In all cases, the MC is disabled during load transfers, to prevent contention between control signals. This prevents a load transfer from being interrupted. Once a load transfer due to an event has occurred, the event detector (ED) is disabled (see section 10; section 11B; operation). Through the MC, the ED can be reset, provided both sources are in the go state. The MC will include a display that indicates the status of the various AMSG system blocks. These indicators include go/nogo, event, and phase rotation indicators.

Operation of the Invention

Load Transfer Sequences:

The three phase voltage source for a specific design is shown graphically in Fig. 12. Each vertex of the triangle corresponds to one of the phases: A, B or C. The peak phase-to-phase voltage is the distance along one side of the triangle. The minimum phase-to-phase voltage is the distance from a vertex to the midpoint of the opposite side. In Fig. 12, these two voltages are shown as 162.6 V and 140.8 V, respectively.

As time advances, the triangle of Fig. 12 rotates counterclockwise about point O at the frequency of the source (60 Hz in this specific design). The maximum phase-to-phase voltage over a 360 degree rotation is shown in Fig. 13, and labeled to show which two phases the voltage is measured between. Also shown is the minimum peak voltage required by the load for this design.

A graphical representation of how a source is connected to a load is shown in Fig. 14. The lines between the source and load correspond to the lines in one of the SCR bank (SCRB) connection configurations discussed in section 3. The arrows on each line indicate in which direction the SCRs are gated to allow conduction. In Fig. 14, the lines are gated bidirectionally. This represents a normal operating condition, where energy is supplied to the load by one power source.

Fig. 15 shows the two power sources connected to the load. Prior to **a** load **transfer** , the old source is supplying energy to the load. Therefore, both SCRs on each line of the old connection configuration are gated to conduct. The new power source in Fig. 15 is out of phase with the old power source. Each phase on the new power source is shown connected to the load phase which most clearly matches it (the load phase voltages are the same as those of the power source supplying it with energy). In addition, each line in the new power source's connection configuration is gated in the direction of the current on the corresponding old phase. Note however, that the SCRs in the new

configuration are not selected to be driven (see section 10; section 11). This situation exists when the old power source is supplying energy to the load, and neither an event nor a manual command has initiated a load transfer.

When a load transfer is initiated (see section 9; section 11), the SCRs of the old connection configuration are deselected. At the same time, the SCRs of the new connection configuration are selected (see section 10; section 11). Only the old SCRs that were conducting will remain on. This is shown in Fig. 16. As the current in the old SCRs reduces to zero they turn off, and the remaining new SCRs are gated. This load transfer sequence is summarized as follows:

1. Event is detected:
   A. Deselect old SCRs. Currently conducting old SCRs will remain on.
   B. Select new SCRs.
2. Current in old SCRs reduces to zero:
   A. Old SCRs turn off.
   B. Gate remaining new SCRs.

The SCRs are selected and deselected via the SCR drivers (SCRD) (section 4) and the driver switch (DS) (section 10), under control of the control unit (section 11). The current in the old SCRs will go to zero in one of three ways. It may go to zero naturally at the next current zero crossover, it may be forced to zero if the new voltage is more favorable to sustain the current, or it may go to zero as the result of a voltage "droop."

Fig. 31 illustrates a flow diagram which is a sequence of operational steps to carry out the transfer of connection of the load from an **old power** source to a new power source based upon the detection of a failure event. The flow diagram of Fig. 31 represents a sequence of operational steps which are encoded in computer instructions which are stored in the RAM or the ROM of the microprocessor in the control unit. When the instructions are executed by the CPU, the functions depicted in the flow diagram of Fig. 1 are performed.

The flow diagram of Fig. 31 is divided into two major portions; the first portion consisting of Steps 20 through 30 is a wait loop wherein the system cyclically waits for an event to occur and during the waiting interval, cyclically monitors for conditions in the system shown in Fig. 1. The second major portion of the flow diagram of Fig. 1 consists of Steps 32 through 46 which result from the detection of an event such as a failure of the old power source, and results in the carrying out and completion of the transfer of connection of the load device from **the** old **power** source to the new power source.

In the wait loop portion of Fig. 31, Step 20 starts the loop wherein the system waits for the event to occur. In Step 22, the coincidence detector monitors the phases of the new power source with respect to the master waveform, as previously described. In Step 24, after the coincidence detector and control unit have identified the phase of the new power source which most closely matches the master waveform, the identity of the configuration for the SCR bank (Fig. 30) which corresponds to that closest match, is stored in the RAM of the microprocessor in the control unit. If the master waveform is considered to be the L1 terminal of the load, and if the A phase of the new power source is found to most closely match the master waveform, then configuration 1 of Fig. 30 is identified as the configuration to be stored in the RAM. In this illustration, the old power source is source 2 in Fig. 1 and the new power source is source 1.

In the flow diagram of Fig. 31, the currents from the old power source 2 are monitored by the current detector I sense 2 of Fig. 1 and the polarity and magnitude (zero or not zero) of the current in each line A(min), B(min) and C(min) are stored in the RAM of the microprocessor of

the control unit, as is designated by Step 28 of Fig. 31. Typically, the wait loop in the flow diagram of Fig. 31 would be repeated frequently enough to maintain valid tracking of the phase and current values being monitored.

The event detector of Fig. 1 monitors failure events which can occur in the system. When the event detector has detected a failure condition for the old source 2, it signals the control unit of the failure condition. Step 30 in the flow diagram of Fig. 31 determines that the failure condition exists and therefore the flow diagram of Fig. 31 branches to Step 32 where all of the old SCR gate drives are turned off through the SCR driver 2. Then in Step 34, the RAM in the microprocessor is read for the last current values of the lines A(min), B(min) and C(min) from the old source 2. In the next Step 36, the RAM is then read for the pattern for configuration of the SCR bank 1, which corresponds to the closest phase match to the master waveform. In this example, the A line for the power source 1 has been previously determined in the wait loop, to be the closest match to the master waveform on the load terminal L1. Next, Step 38 of Fig. 31 makes use of the phase matching data read from the RAM during Step 36. Configuration 1 for the SCR bank of Fig. 30 has the A line of power source 2 coupled to the L1 terminal of the load. Further assume that the last monitoring of currents into the load showed that the L1 terminal and the L2 terminal had current flowing into the load and the L3 terminal had current flowing out of the load. In response to these determinations, Step 38 turns on the first half of each new pair of SCRs in the SCR bank 1 so that the resulting currents supplied by the new source 1 supplement the old currents from the old source 2. In order to do this, the SCR gate drive signals on lines 1, 4 and 6 are turned on at substantially the same time. This renders the respective SCRs in a conductive state so that when their anode is relatively more positive than their cathode, they will begin conducting current from the new source 1 into or out of the load, as required in this example.

Step 40 of the flow diagram of Fig. 31 continues monitoring the decaying currents in the old lines A(min), B(min) and C(min) in order to determine when it is appropriate to turn on the second half of each pair of SCRs in the new SCR bank 1. As the current decays in each line A(min), B(min) and C(min) from the old source 2, the first current to decay substantially to zero will cause the corresponding SCR pair to have its second SCR turn on. Assume in this example that the current in line A(min) goes to zero first. Then, at this point SCR gate drive signal line 3 would be enabled and the SCR 3 would be rendered into a conductive state so that the path from line A to the terminal L1 becomes a bidirectional path, as provided in Step 42 of the flow diagram of Fig. 31.

Next, the second and third lines B(min) and C(min) will decay to substantially zero current at approximately the same time. When the current detector I sense 2 makes this determination, the control unit causes the SCR driver 1 to apply SCR gate drive signals on the remaining two SCR gate drive lines 2 and 5, thereby rendering the SCRs 2 and 5 in a conductive state so that when their respective anodes have a more positive potential than their cathodes, they will begin conducting current thereby making their corresponding paths bidirectional.

In this manner, the **transfer** of **power** sources from source 2 to **source** 1 **is** completed, as is provided by Step 46.

When a load transfer takes place, several different situations may exist. The new voltage may lead or lag the old voltage, the old current may lead or lag the old voltage, or the old current may lead or lag the new voltage.

Following, each possible combination of leading and lagging voltages and current are graphically represented. The graphs have been divided into zones with a written description of what happens during a load

transfer sequence initiated in that zone. Only a single phase is shown in each case, but all three phases of the power source will be in one of the zones of one of the cases.

Each zone description begins by describing which voltage (old or new) sources or sinks the load, and when the old current goes to zero, assuming that both power sources are good. After this, the voltage "droop" situation is described. The situation where the voltage drops out suddenly is not described, because in all cases, the old current would immediately go to zero, and the new power source would take over the load.

In the following example cases the variables V, I and V(min) represent:

V = Old voltage.
I = Old current.
V(min) = New voltage.

Case 1 is represented in Fig. 17.

Case 1: New voltage in phase with old voltage.
Old current in phase with old voltage.

Case 2 is represented in Fig. 18.

Case 2: New voltage in phase with old voltage.
Old current lags old voltage.

Case 3 is represented by Fig. 19.

Case 3: New voltage in phase with old voltage.
Old current leads old voltage.

Case 4 is represented by Fig. 20.

Case 4: New voltage lags old voltage.
Old current in phase with old voltage.

Case 5A is represented by Fig. 21.

Case 5A: New voltage lags old voltage.
Old current lags old voltage.
Old current leads new voltage.

Case 5B is represented by Fig. 22.

Case 5B: New voltage lags old voltage.
Old current lags old voltage.
Old current lags new voltage.

Case 6 is represented by Fig. 23.

Case 6: New voltage lags old voltage.
Old current leads old voltage.

Case 7 is represented by Fig. 24.

Case 7: New voltage leads old voltage.
Old current in phase with old voltage.

Case 8 is represented by Fig. 25.

Case 8: New voltage leads old voltage.
Old current lags old voltage.

Case 9A is represented by Fig. 26.

Case 9A: New voltage leads old voltage.
Old current leads old voltage.
Old current lags new voltage.

Case 9B is represented by Fig. 27.

Case 9B: New voltage leads old voltage.
Old current leads old voltage.
Old current leads new voltage.

The AMSG design performs make-before-break switching of AC power sources to a load requiring an uninterrupted supply of energy. Applications range from those previously stated to telephone and banking activities, where power outages resulting in data losses cannot be tolerated.

The AMSG approach could reduce distribution outages caused by equipment failures for power utilities. **Blackouts** that have been caused by the loss of power could be handled in a very different manner that would allow alternative paths for routing power to an affected area. With a

switching system that can transfer the load without a loss of power, there would be no turn-on surge to affect the new source.

When a power line fails, it is typically one of several feeder circuits to a larger grid supporting the load area. The other feeders cannot absorb the shock of a "cold load" even if the running load was within transmission line kilo volt ampere (KVA) capacity. Using the AMSG can allow the running load to be reallocated without losing "momentum," which would cause the start-up surge. The relative amplitude of this surge is determined by the characteristics of the utilizing loads and commonly ranges from 5 to 10 times the actual load requirement. Incandescent lighting and the starting of motors are two examples of loads found in common usage that have high initial surge characteristics.

If the impending power failure could be detected and acted upon quickly, it is possible to allow the shedding or reallocating of the load to recover without interrupting power. With the freedom to transfer loads quickly from one power source to another, sharing the loads and balancing capacities becomes a simple task. The greatest gain is that there is no need to have the power systems in synchronism to allow switching. Power from several sources can be used with freedom not previously available.

Make-before-break switching has a very important advantage over other switching methods: the load does not see a source interruption at the time of transfer. Because of the reactive nature of the load, when the source of current is broken, inductive recovery effects cause the voltage across the load terminals to spike to potentially damaging values. This effect causes long term stress and degradation of electrical components. Transfer of a load between power sources can cause even greater stress if the time between application of power sources is small, or the phase voltages are inverted, causing a double voltage effect.

AMSG operation never allows the load to see an open circuit, preventing this uncontrolled inductive recovery. The load is never removed from a power source. Instead, it is allowed to propagate from one source to another as the respective phase voltages of the new source assume the load currents. Thus there is a gradual release of loading on the old bus and a ramping up of new bus currents. In high power applications, the reduction of transient spikes becomes a very necessary goal that has large economic benefits.

The AMSG design provides make-before-break AC **power** switching, asynchronous **transfer** of **power** between unsynchronized polyphase sources, and a reduction in switching noise and disturbance to the system during a transfer.

CLAIMS EP 313926 B1

1. An asynchronous multiphase switching circuit for transferring the connection of a three phase load from a first three phase power source to a second three phase power source, comprising:

a first SCR bank switchably connecting said load to said first power source and a second SCR bank for switchably connecting said load to said second power source;

a waveform coincidence detector circuit having inputs connected to said first power source and said second power source, for continuously monitoring the phase relationship between the voltages on the first power source and the voltages on the second power source;

a control unit having an input connected to an output from said waveform coincidence detector, and an output connected to said first SCR bank and said second SCR bank, for determining the sequence for connecting the three phases from said second power source to said load through said second SCR bank when said first power source stops supplying power to said load, by determining which phase on said second power source most closely matches a current phase waveform at

said load;

whereby the disruption in three phase power being supplied to said load is minimized.

2. An asynchronous multiphase switching circuit for switching a three phase load from an existing three phase power source to a takeover three phase power source, said existing power source having three output voltage terminals whose voltage phase sequence is characterized by an existing phase rotation order, said takeover power source having three output voltage terminals whose voltage phase sequence is characterized by a takeover phase rotation order, comprising:

a first SCR bank having three paths, each respectively connecting each of said output voltage terminals of said existing power source to one of three terminals of said load, establishing said existing phase rotation order at said load, each said path including a pair of oppositely polled, parallel connected SCR devices enabled by gate drive signals from a first SCR driver;

an event detector having an input connected to said load and having an output connected to said first SCR driver, for turning off said gate drive signals in response to detecting a power failure from said existing power source to said load;

a control unit having an input connected to said event detector, for registering the detection of said power failure to said load;

a waveform coincidence detector having a load master voltage waveform input connected to one of said three terminals of said load and three source inputs each respectively connected to one of said output voltage terminals of said takeover power source, and an output connected to said control unit, for identifying which one of said three output voltage terminals of said takeover power source has a voltage waveform which most closely matches said load master voltage waveform and outputting the resulting identity of the takeover source terminal to said control unit;

a second SCR bank having an input coupled to said control unit for establishing three selectable paths, each respectively connecting a selected one of said output voltage terminals of said takeover power source to one of said terminals of said load so that said takeover phase rotation order is in the same sequence as said existing phase rotation order at said load, said selectable paths being selected by said control unit to connect said identified one of said three output voltage terminals of said takeover power source to said one of said three load terminals having said master voltage waveform, each said selectable path including a pair of oppositely polled, parallel connected SCR devices enabled by gate drive signals from a second SCR driver;

a current sensor having three inputs each respectively connected to one of said three paths of said first SCR bank, and an output connected to said control unit, for determining the direction and magnitude of the current flowing in each one of said three paths of said first SCR bank;

said control unit having an output connected to said second SCR driver, for connecting said takeover power source to said load in response to said detection of said power failure from said existing power source to said load, by controlling said second SCR driver to output gate drive signals to a first SCR in each said pair of SCRs in each one of said three selectable paths, to provide an initial current having the same direction in each corresponding one of said three terminals of said load as the existing current therein at the instant when said power failure has been detected, followed by said control unit controlling said second SCR driver to output gate drive signals to a second SCR in each said pair of SCRs in each one of said

three selectable paths, when the magnitude of the current flowing in each corresponding one of said three paths of said first SCR bank is substantially zero;

whereby a smooth transition can be made in transferring the load from the existing power source to the takeover power source.

3. An asynchronous multiphase switching circuit to transfer a three phase load from an existing three phase power source to a takeover three phase power source, said existing power source having three output voltage terminals whose voltage phase sequence is characterized by an existing phase rotation order, said takeover power source having three output voltage terminals whose voltage phase sequence is characterized by a takeover phase rotation order, comprising:

a first SCR bank having three paths, each respectively connecting each of said output voltage terminals of said existing power source to one of three terminals of said load, establishing said existing phase rotation order at said load, each said path including a pair of oppositely polled, parallel connected SCR devices enabled by gate drive signals from a first SCR driver;

an initiating means having an output connected to said first SCR driver, for outputting a signal initiating said transfer by turning off said gate drive signals;

a control unit having an input connected to said initiating means, for registering the initiation of said transfer;

a waveform coincidence detector having a load master voltage waveform input connected to one of said three terminals of said load and three source inputs each respectively connected to one of said output voltage terminals of said takeover power source, and an output connected to said control unit, for identifying which one of said three output voltage terminals of said takeover power source has a voltage waveform which most closely matches said load master voltage waveform and outputting the resulting identity of the takeover source terminal to said control unit;

a second SCR bank having an input coupled to said control unit for establishing three selectable paths, each respectively connecting a selected one of said output voltage terminals of said takeover power source to one of said terminals of said load so that said takeover phase rotation order is in the same sequence as said existing phase rotation order at said load, said selectable paths being selected by said control unit to connect said identified one of said three output voltage terminals of said takeover power source to said one of said three load terminals having said master voltage waveform, each said selectable path including a pair of oppositely polled, parallel connected SCR devices enabled by gate drive signals from a second SCR driver;

a current sensor having three inputs each respectively connected to one of said three paths of said first SCR bank, and an output connected to said control unit, for determining the direction and magnitude of the current flowing in each one of said three paths of said first SCR bank;

said control unit having an output connected to said second SCR driver, for connecting said takeover power source to said load in response to said output signal from said initiating means, by controlling said second SCR driver to output gate drive signals to a first SCR in each said pair of SCRs in each one of said three selectable paths, to provide an initial current having the same direction in each corresponding one of said three terminals of said load as the existing current therein when said initiating means outputs said signal, followed by said control unit controlling said second SCR driver to output gate drive signals to a second SCR in

each said pair of SCRs in each one of said three selectable paths, when the magnitude of the current flowing in each corresponding one of said three paths of said first SCR bank is substantially zero;

whereby a smooth transition can be made in transferring the load from the existing power source to the takeover power source. to said one of said three load terminals having said master voltage waveform, each said selectable path including a pair of oppositely polled, parallel connected SCR devices enabled by gate drive signals from a second SCR driver (2);

said circuit further includes a current sensor having three inputs each respectively connected to one of said three paths of said first SCR bank (1), and an output connected to said control unit, for determining the direction and magnitude of the current flowing in each one of said three paths of said first SCR bank (1);

said control unit having an output connected to said second SCR driver (2), for connecting said takeover power source (A', B', C') to said load in response to said detection of said power failure from said existing power source to said load, by controlling said second SCR driver (2) to output gate drive signals to a first SCR (1) in each said pair of SCRs in each one of said three selectable paths, to provide an initial current having the same direction in each corresponding one of said three terminals of said load as the existing current therein at the instant when said power failure has been detected, followed by said control unit controlling said second SCR driver (2) to output gate drive signals to a second SCR (2) in each said pair of SCRs in each one of said three selectable paths, when the magnitude of the current flowing in each corresponding one of said three paths of said first SCR bank is substantially zero;

whereby a smooth transition can be made in transferring the load from the existing power source to the takeover power source.

3. An asynchronous multiphase switching circuit according to claim 2, wherein said event detector further includes an initiating means having an output connected to said first SCR drive, for outputting a signal initiating said transfer by turning off said gate drive signals.

CLAIMS EP 313926 B1

1. Ein asynchroner mehrphasiger Schaltkreis zum Ubertragen des Anschlusses einer dreiphasigen Last (L(sub 1), L(sub 2), L(sub 3),) von einer ersten dreiphasigen Stromquelle (A, B, C) auf eine zweite dreiphasige Stromquelle (A', B', C'), mit:

einer ersten SIT-Gruppe (1), die die Last mit der ersten Stromquelle (A, B, C) schaltbar verbindet und einer zweiten SIT-Gruppe (2), die die Last mit der zweiten Stromquelle (A', B', C') schaltbar verbindet;

einem Wellenform-Koinzidenzdetektorschaltkreis, dessen Eingange mit der ersten Stromquelle (A, B, C) und mit der zweiten Stromquelle (A', B', C') verbunden sind, damit die Phasenbeziehungen zwischen den Spannungen an der ersten Stromquelle und die Phasenbeziehungen zwischen den Spannungen an der zweiten Stromquelle kontinuierlich uberwacht werden und damit bestimmt werden kann, welche Phase an der zweiten Stromquelle am besten mit einer Stromphasenwellenform an dieser Last ubereinstimmt;

einer Steuereinheit, bei der ein Eingang mit einem Ausgang des Wellenform-Koinzidenzdetektors verbunden ist, und bei der ein Ausgang mit der ersten SIT-Gruppe (1) und mit der zweiten SIT-Gruppe (2) verbunden ist, damit die Abfolge fur den Anschlus der drei Phasen der zweiten Stromquelle (A', B', C') an die Last uber die zweite SIT-Gruppe (2) bestimmt werden kann, wenn die erste Stromquelle (A, B, C) die Energiezufuhrung zur Last einstellt;

wobei die Unterbrechung des zur Last zugefuhrten Dreiphasenstroms

minimiert ist.

2. Ein asynchroner mehrphasiger Schaltkreis gemas Anspruch 1, bei dem die bestehende Stromquelle drei Ausgangsspannungsanschlusse besitzt, deren Spannungsphasenfolge durch eine bestehende Reihenfolge der Phasenfolge gekennzeichnet ist (A-B-C-A-B-C-A), und bei dem die ubernehmende Stromquelle drei Ausgangsspannungsanschlusse besitzt, deren Spannungsphasenfolge durch eine Ubernahmereihenfolge der Phasenfolge gekennzeichnet ist (A'-B'-C'-A'-B'-C'-A),

die erste SIT-Gruppe (1) besitzt drei Pfade, von denen jeweils jeder Pfad jeden der Ausgangsspannungsanschlusse der bestehenden Stromquelle (A, B, C) mit einem der drei Anschlusse der Last verbindet, und so die bestehende Reihenfolge der Phasenfolge (A-B-C-A-B-C-A) der Last bestimmt, wobei jeder Pfad ein Paar positiv gepolter, parallel geschalteter SIT-Gerate beinhaltet, die durch Toransteuerungssignale der ersten SIT-Ansteuerung (1) freigegeben sind;

der Schaltkreis enthalt ferner einen Ereignisdetektor, der mit einem Eingang an der Last (L(sub 1), L(sub 2), L(sub 3)) angeschlossen ist, und der mit einem Ausgang an der ersten Ansteuerung (1) angeschlossen ist, um die Toransteuerungssignale als Reaktion auf die Feststellung eines Stromausfalles der bestehenden Stromquelle zur Last abzuschalten;

die Steuereinheit hat einen Eingang, der fur den Zweck der Registrierung der Feststellung des Stromausfalls zur Last mit dem Ereignisdetektor verbunden ist;

der Wellenform-Koinzidenzdetektor hat einen Last-Hauptspannungswellenformeingang, der mit einem der drei Anschlussen der Last verbunden ist, sowie drei Stromquelleneingange (A, B, C), die jeweils mit einer der Ausgangsspannungsanschlusse der ubernehmenden Stromquelle verbunden sind, und einen Ausgang, der mit der Steuereinheit verbunden ist, damit festgestellt werden kann, welche der drei Ausgangsspannungsanschlusse der ubernehmenden Stromquelle (A', B', C') eine Spannungswellenform besitzt, die am besten mit der Last-Hauptspannungswellenform ubereinstimmt, und damit die resultierende Identitat des ubernehmenden Stromquellenanschlusses an die Steuereinheit ausgegeben werden kann.

die zweite SIT-Gruppe (2) hat einen Eingang, der mit der Steuereinheit fur den Zweck gekuppelt ist, drei wahlbare Pfade zu bestimmen, die jeweils einen der ausgewahlten Ausgangsspannungsanschlusse der ubernehmenden Stromquelle (A', B', C') mit einem der Anschlusse der Last so verbinden, das die ubernehmende Reihenfolge der Phasenfolge (A'-B'-C'-A'-B'-C'-A') in der gleichen Reihenfolge wie die Reihenfolge der bestehenden Phasenfolge bei der Last (L(sub 1)-L(sub 2)-L(sub 3)-L(sub 1)-L(sub 2)-L(sub 3)-L(sub 1)) ist, wobei die wahlbaren Pfade von der Steuereinheit ausgewahlt werden, um den festgestellten der drei Ausgangsspannungsanschlusse der ubernehmenden Stromquelle mit einem der drei Lastanschlusse, der die Hauptspannungswellenform hat, zu verbinden, wobei jeder wahlbare Pfad ein Paar gegensatzlich gepolte parallel geschaltete SIT-Gerate beinhaltet, die durch Toransteuerungssignale von einer zweiten SIT-Ansteuerung (2) freigesetzt werden;

der Schaltkreis umfast ferner einen Stromsensor mit drei Eingangen, die jeweils mit einem der drei Pfade der ersten SIT-Gruppe (1) verbunden sind, und einen Ausgang, der mit der Steuereinheit zur Feststellung der Richtung und Grose des Stroms, der in jedem der drei Pfade der ersten SIT-Gruppe (1) fliest, verbunden ist;

die Steuereinheit hat einen Ausgang, der an die zweite SIT-Ansteuerung (2) fur den Zweck angeschlossen ist, als Reaktion auf die Feststellung des Stromausfalles der bestehenden Stromquelle zur

Last die ubernehmende Stromquelle (A', B', C') mit der Last zu verbinden, indem die zweite SIT-Ansteuerung (2) so gesteuert wird, das sie an den ersten SIT (1) in jedem SIT-Paar in jedem der drei wahlbaren Pfade Toransteuerungssignale aussendet, um einen Anfangsstrom zur Verfugung zu stellen, der im Moment der Feststellung des Stromausfalls in jedem der drei Anschlusse der Last die gleiche Richtung hat wie beim bestehenden Strom, gefolgt von der Steuereinheit, die die zweite SIT-Ansteuerung (2) so steuert, das diese an den zweiten SIT (2) in jedem SIT-Paar in jedem der drei wahlbaren Pfade Toransteuerungssignale aussendet, wenn die Grose des Stroms, der in jeweils jedem der drei Pfade der ersten SIT-Gruppe fliest, praktisch Null ist;

wobei die Ubertragung der Ladung von der bestehenden Stromquelle auf die ubernehmende Stromquelle reibungslos durchgefuhrt werden kann.

3. Ein asynchroner mehrphasiger Schaltkreis gemas Anspruch 2, bei dem der Ereignisdetektor zusatzlich eine Ausloseeinrichtung mit einem Ausgang besitzt, der mit der ersten SIT-Ansteuerung verbunden ist, damit ein Signal ausgegeben werden kann, der die Ubertragung durch die Abschaltung der Toransteuerungssignale auslost.

CLAIMS EP 313926 B1

1. Circuit de commutation polyphase asynchrone pour transferer la connexion d'une charge triphasee (L(sub 1),L(sub 2),L(sub 3)), d'une premiere source d'energie triphasee (A,B,C) a une deuxieme source d'energie triphasee (A', B',C'), comprenant :

un premier groupe de redresseurs au silicium commandes SCR (1) connectant de facon commutable ladite charge a ladite premiere source d'energie (A,B,C) et un deuxieme groupe de redresseurs SCR (2) pour connecter de facon commutable ladite charge a ladite deuxieme source d'energie (A',B',C') ;

un circuit de detection de coincidence de formes d'onde ayant des entrees raccordees a ladite premiere source d'energie (A,B,C) et a ladite deuxieme source d'energie (A',B',C'), pour controler de facon continue la relation de phase entre les tensions de la premiere source d'energie et les tensions de la deuxieme source d'energie et pour determiner la phase de ladite deuxieme source d'energie qui concorde le plus etroitement avec une forme d'onde de phase en cours a ladite charge ;

une unite de commande ayant une entree raccordee a une sortie dudit detecteur de coincidence de formes d'onde et une sortie raccordee audit premier groupe SCR (1) et audit deuxieme groupe SCR (2),pour determiner la sequence de connexion des trois phases de ladite deuxieme source d'energie (A',B',C') a ladite charge par l'intermediaire dudit deuxieme groupe SCR (2) lorsque ladite premiere source d'energie (A,B,C) cesse de fournir une alimentation en energie a ladite charge ;

de sorte que la disruption de l'alimentation triphasee fournie a ladite charge est minimisee.

2. Circuit de commutation polyphase asynchrone suivant la revendication 1, dans lequel ladite source d'energie existante comporte trois bornes de tension de sortie dont la sequence de phase de tension est caracterisee par un ordre de rotation des phases existant (A-B-C-A-B-C-A), ladite source d'energie de remplacement comporte trois bornes de tension de sortie dont la sequence de phase de tension est caracterisee par un ordre de rotation des phases de remplacement (A'-B'-C'-A'-B'-C'-A'),

ledit premier groupe SCR (1) comporte trois chemins, reliant chacun respectivement chacune des dites bornes de tension de sortie de ladite source d'energie existante (A,B,C) a une des trois bornes de ladite charge et etablissant ledit ordre de rotation des phases

existant (A-B-C-A-B-C-A) a ladite charge, chaque dit chemin comprenant deux dispositifs SCR connectes en parallele et a poles en opposition, actives par des signaux d'excitation de gachette fournis par une premiere unite de pilotage de SCR (1) ;

ledit circuit comprend en outre un detecteur d'evenement comportant une entree raccordee a ladite charge (L(sub 1),L(sub 2),L(sub 3)) et comportant une sortie raccordee a ladite premiere unite de pilotage de SCR (1), pour couper lesdits signaux d'excitation de gachette en reponse a la detection d'une defaillance de l'alimentation fournie par ladite source d'energie existante a ladite charge ;

ladite unite de pilotage comporte une entree raccordee audit detecteur d'event, pour enregistrer la detection de ladite defaillance d'alimentation de ladite charge ;

ledit detecteur de coincidence de formes d'onde comporte une entree de forme d'onde de tension maitresse de charge raccordee a une desdites trois bornes de ladite charge,et trois entrees de source (A,B,C) raccordees chacune respectivement a une desdites bornes de tension de sortie de ladite source d'energie de remplacement, et une sortie raccordee a ladite unite de commande, pour identifier celle desdites trois bornes de tension de sortie de ladite source d'energie de remplacement (A',B',C') qui a une forme d'onde de tension qui concorde le plus etroitement avec ladite forme d'onde de tension maitresse de la charge, et pour fournir l'identite resultante de la borne de la source de remplacement a ladite unite de commande ;

ledit deuxieme groupe SCR (2) comporte une entree raccordee a ladite unite de commande pour etablir trois chemins selectables, reliant chacun respectivement une borne choisie parmi lesdites bornes de tension de sortie de ladite source d'energie de remplacement (A',B',C') a une desdites bornes de ladite charge de sorte que ledit ordre de rotation des phases de remplacement (A'-B'-C'-A'-B'-C'-A') soit dans la meme sequence que ledit ordre de rotation des phases existant a la dite charge (L(sub 1)-L(sub 2)-L(sub 3)-L(sub 1)-L(sub 2)-L(sub 3)-L(sub 1)), lesdits chemins selectables etant choisis par ladite unite de commande de maniere a connecter ladite borne identifiee desdites trois bornes de tension de sortie de ladite source d'energie de remplacement a ladite une borne desdites trois bornes de la charge qui a ladite forme d'onde de tension maitresse, chaquedit chemin selectable comprenant deux dispositifs SCR connectes en parallele et en opposition de polarite, actives par des signaux d'excitation de gachette fournis par une deuxieme unite de pilotage de SCR (2) ;

ledit circuit comprend en outre un detecteur de courant comportant trois entrees, raccordees chacune respectivement a un desdits trois chemins dudit premier gorupe SCR (1) et une sortie raccordee a ladite unite de commande, pour determiner le sens et la grandeur du courant circulant dans chacun desdits trois chemins dudit premier groupe SCR (1) ;

ladite unite de commande comporte une sortie raccordee a ladite deuxieme unite de pilotage de SCR (2), pour connecter ladite source d'energie de remplacement (A',B',C') a ladite charge en reponse a ladite detection de ladite defaillance d'alimentation en energie fournie par ladite source d'energie existante a ladite charge, par commande de ladite deuxieme unite de pilotage de SCR (2) afin de fournir des signaux d'excitation de gachette a un premier SCR (1) de chaque dite paire de SCR dans chacun desdits trois chemins selectables, de maniere a fournir un courant initial de meme sens,dans chaque borne correspondante desdites trois bornes de ladite charge, que le courant existant dans cette borne a l'instant ou ladite defaillance d'alimentation a ete detectee, puis par commande,

par ladite unite de commande, de ladite deuxieme unite de pilotage de SCR (2) de maniere a fournir des signaux d'excitation de gachette a un deuxieme SCR (2) de chaque dite paire de SCR dans chacun desdits trois chemins selectables, lorsque la grandeur du courant circulant dans chaque chemin correspondant desdits trois chemins dudit premier groupe SCR est sensiblement nulle ;

de sorte qu'une transition douce peut etre obtenue dans le transfert de la charge, de la source d'energie existante a la source d'energie de remplacement.

3. Circuit de commutation polyphase asynchrone suivant la revendication 2, dans lequel ledit detecteur d'evenement comprend en outre des moyens de demarrage comportant une sortie connectee a ladite premiere unite de pilotage de SCR, pour fournir un signal demarrant ledit transfert par coupure desdits signaux d'excitation de gachette.

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